SCIENTIFIC AMERICAN

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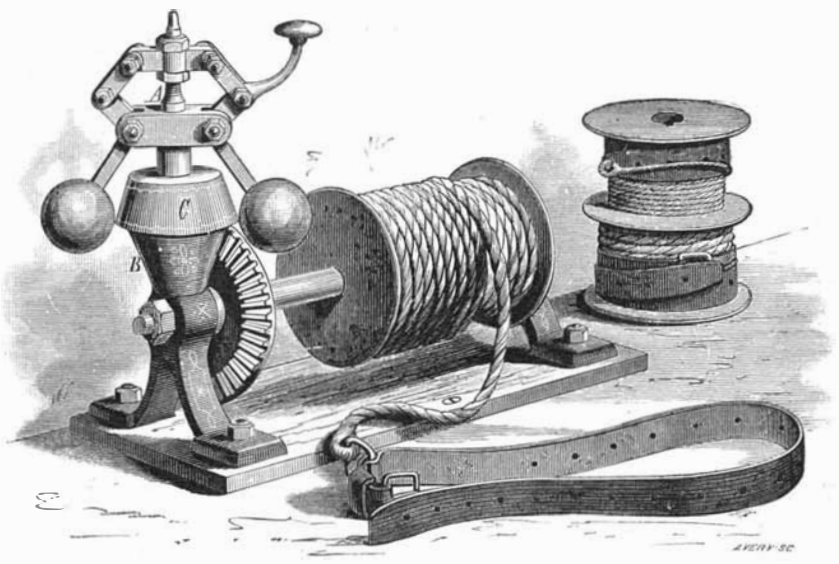
IMPROVED AUTOMATIC FIRE ESCAPE.

The accompanying engraving represents a new fire escape, whereby a person may escape from a burning building without the help of any one else, and with no exertion on his part beyond the buckling on of a simple belt. The device is entirely automatic, and is claimed to let down heavy or light weights without change of speed. Its mechanism is positive and free from springs and catches, and its construction is sufficiently strong to guard against accident by breakage.

The lowering rope to which the belt which the person escaping buckles around him is attached, is wound upon a drum, on the shaft of which is the bevel gear wheel shown. Meshing with this wheel is a bevel pinion (not exhibited in the engraving) on the vertical shaft, A. The upper portion of the standard, B, in which the drum shaft is journaled, and in which also steps the shaft, A, is flared to receive the bevel pinion. The latter engages with the gear wheel through an opening in this flared portion. On a sleeve which traverses on the shaft, A, is formed the inverted cup or hollow conical frustrum, C. Also on the sleeve is attached the crossbar which receives the lever arms of the ordinary ball governor shown.

It will be obvious that when the drum is caused to rotate by the drum unwinding as a person descends, the governor will likewise be revolved, and the balls will fly out more nearly horizontal as the speed augments. But as the balls move outward their levers carry downward the sleeve on shaft, A, and consequently jam the cup, C, over the stationary flared portion of the standard. The cup thus acts as a brake which is the more closely applied in proportion as the velocity of descent increases. The machine is intended to be bolted on the floor inside the apartment and hence is protected from the weather. After the rope has been unwound it can easily be wound up again by a handle, or the drum may be made double as shown at the right of the engraving and have two ropes upon it—either hemp or wire as indicated—wound in reverse directions. Then when one rope is unrolled, the other is rolled. Belts with simple buckles are attached to each.

Patented August 28, 1877. For further information address Mr. Charles Leavitt, 453 Prospect street, Cleveland, Ohio. E. Dunbar, agent, 31 Courtlandt street, New York.



AUTOMATIC FIRE ESCAPE.

Effect of Salt Water on Candles.

Some candles which had been sunk in the wreck of a vessel off the Spanish coast for about 173 years have been examined by Professor Gladstone. The wicks had all rotted away, and the fat had been converted into a heavy substance of a dull white color by the action of the salt water. After the fat had been removed by ether, there remained carbonate and chloride of calcium and sodium, with traces of potassium and magnesium. The calcium, though less abundant than sodium in the ocean, had apparently the greatest influence in effecting the change noted; but notwithstanding the length of time the fat had been exposed, the reaction had only been about one half accomplished.

AN OBELISK AT SEA.

We have already described the manner in which Cleopatra's needle, the obelisk presented by the Khedive of Egypt to the British Government, has been built as it were in a vessel, and so made ready for the voyage to England. The annexed illustration represents the Cleopatra, as the vessel containing the stone is called, *en route*. The following particulars of the launch of the ship we take from *Engineering*. The cabin recess of the ship was filled with old rails to balance the eccentrically placed obelisk, and the cylinder was lagged with 6 inch planks for a length of about 12 feet at each end, in order to protect the iron skin against possible injury from the stones on the sea bed. Some half dozen screw-jacks were ranged along the cylinder to start it down the incline, which had been formed of quarry rubbish from the shore to the point where the cylinder would float, and a couple of lighters with winches were moored ahead to haul on the wire hawsers, which were wound five times round the cylinder at each end. The screw-jacks were manned, and the ship went slowly and surely ahead, making in the course of the day two attempts to run off to sea, amidst the cheers of the lookers-on, but stopping each time after about a quarter of a turn had been made, so that at sunset the cylinder had advanced into but 3 feet of water.

On the morning of the second day the jacks were set to work again, and with the help of the tugs the cylinder took a fine roll into about 7 feet of water, and then to the disappointment of all again pulled up. The tugs were backed and ran at the hawsers again and again, until towing tackle and almost everything was smashed, except the splendid steel wire hawser. It was then discovered that the cylinder was full of water, and the manhole covers being downwards, it was considered probable that one of them had been torn

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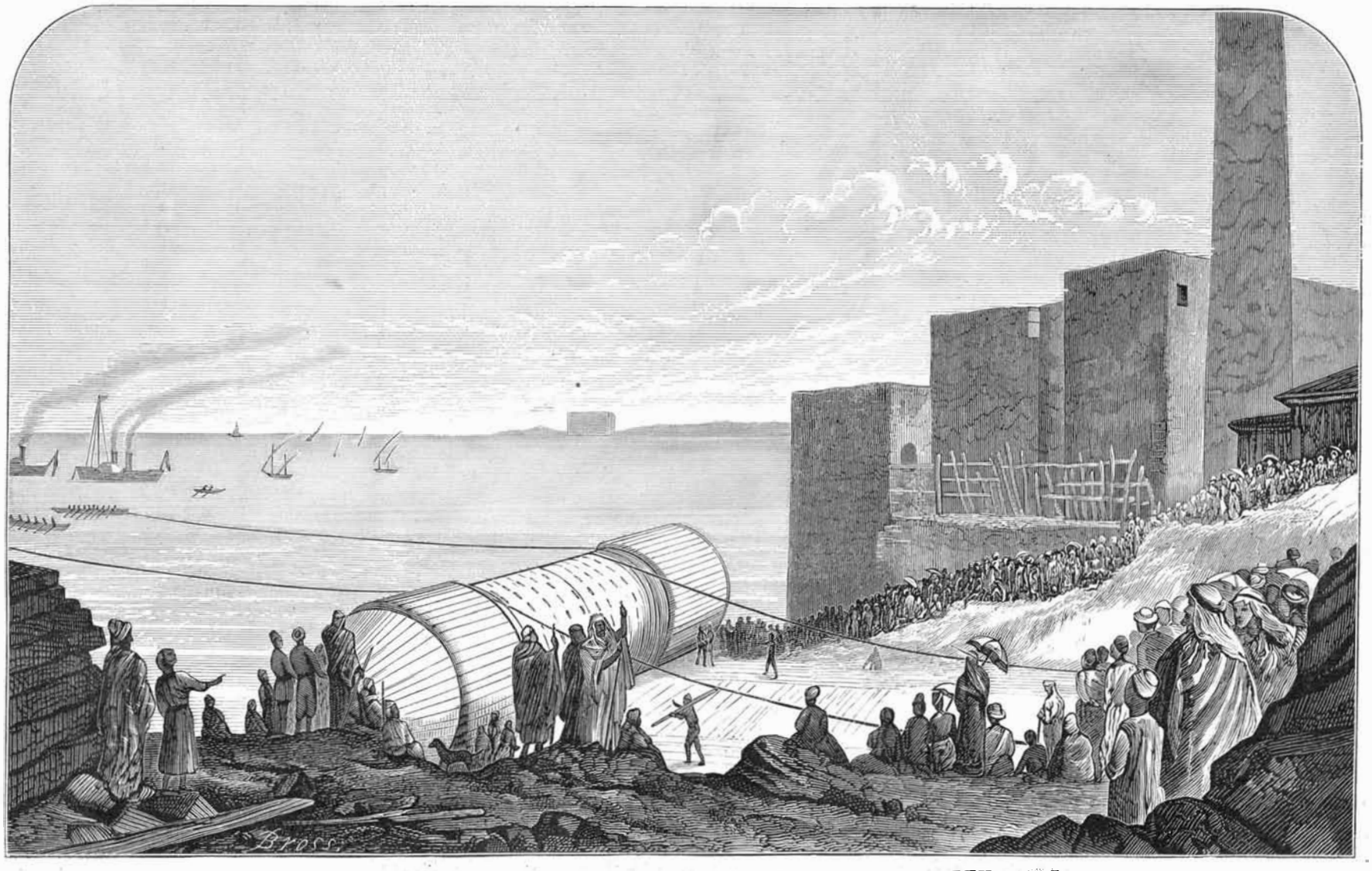

CLEOPATRA'S NEEDLE.—LAUNCH OF THE OBELISK AT ALEXANDRIA.

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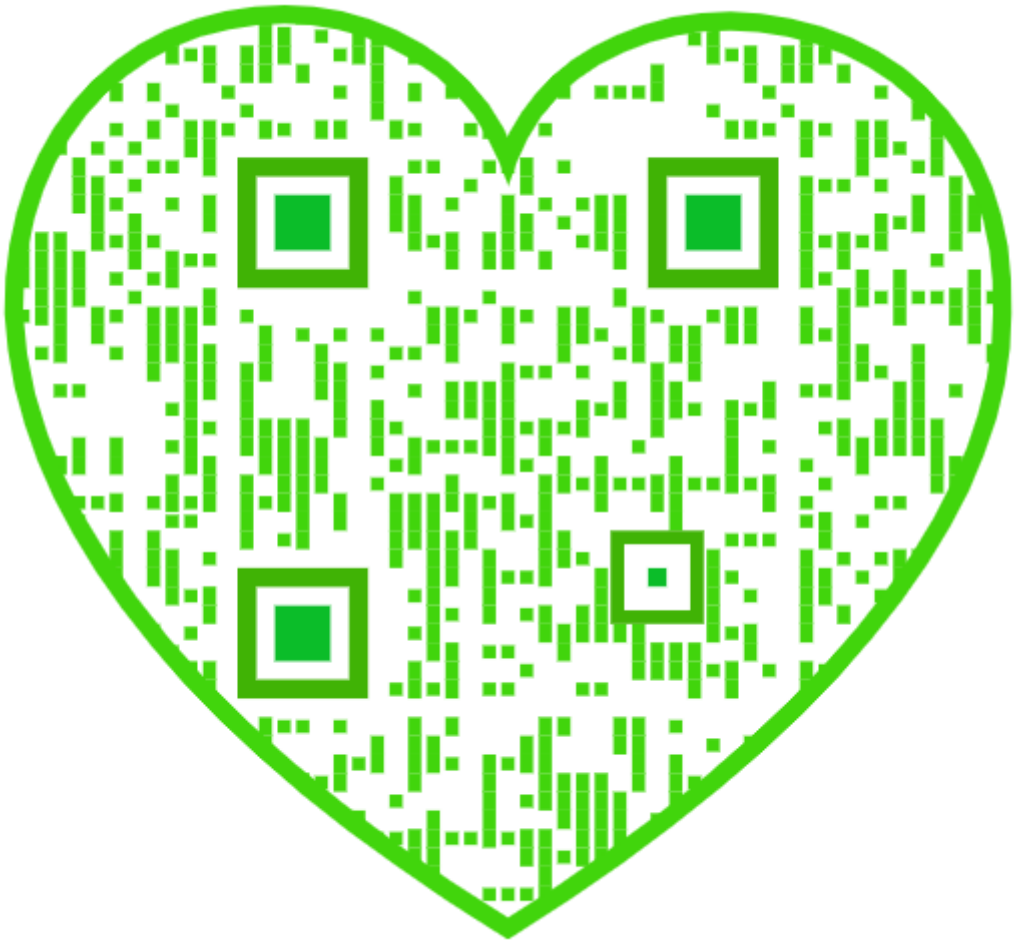

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CURIOUS ANIMAL RELATIONSHIPS.

As paleontogical discoveries multiply, they reveal to us in a constantly increasing degree the mobility of the beings of which our earth has seen the successive development. All living creatures of past ages have been ephemeral, and those whose histories are the shortest seem curiously enough to have been the ones which possessed the greatest strength. Such monsters as the dinotherium, the dinoceras, the brontotherium, etc., existed over but a comparatively brief period; and it might almost be conceived that, because these giants expended vast quantities of vital energy, the quicker was the same used up.

Among these fossil beings, the mammifers which have characterized the third great phase of the history of nature, called the tertiary epoch, offer conditions particularly favorable for the study of questions relative to evolution. At this epoch they formed a striking contrast with the rest of animate creation. The plants then belonged to present genera; their generic transformations were accomplished, and modification was restricted to species and races. The great traits of the invertebrata were nearly all defined; their species varied, their genera and families likewise, but in degree. The fishes had reached their highest development, the reptiles had passed theirs and were diminishing. But the mammifers were then in full evolution; and in the enormous multitude of species—a new form almost for every instant of geological time—some were suddenly appearing, others as suddenly disappearing. In the midst of this confusion there may be traced, however, certain curious chains of development, and to some of these, M. Gaudry devotes an admirable paper in the *Revue des Deux Mondes*.

Among the placental mammifers which played a prominent part in tertiary times are those to which, on account of their thick skin, the name pachyderm has been given. At the present time they are scattered, and between the various species there seems little or no relationship. The hog, the rhinoceros, and the tapir, for example, differ widely. But when we go back to the fossils, we find that preceding the hog of to-day there has been a whole succession of fossil hogs, then animals of a genus closely related, called hyotherium; this in turn is related to the paleochœrus so closely that the two are often confounded. The paleochœrus in turn again differs little from the chœropotamus and dichobune. Now the present rhinoceros was preceded by tertiary rhinoceri. Between these and the hornless animal known as the acerotherium, it is easy to trace relationship. The latter may be connected with the paleotherium; and of this last the remains are found with those of the chœropotamus in Montmartre gypsum, and thus the connection between the rhinoceros and the hog is established. Similarly a chain of relationship can be found between these animals and the tapir.

But the signs of transition are not merely apparent between pachyderm and pachyderm, but between the pachyderm order and that of the ruminants. It would hardly be supposed that the light and graceful antelope bears any relationship to the unwieldy rhinoceros; yet paleontologists are supplying the connecting links. The majority of ruminants differ from the pachyderms, in that the former have horns on the frontal bones, but the first ruminants had no horns; later the horns were but rudimentary, and branching antlers arrived still more recently. Present ruminants are also unlike pachyderms in their lack of incisive teeth on the upper jaw, but ancient ruminants had such teeth. The molars of present ruminants are especially adapted to mastication of herbs, those of pachyderms are suited for crushing hard bodies. Yet the hog's molars resemble those of the anthracotherium, and from this creature, through the hyopotamus, the lophiomeryx, and the dorcatherium, can be traced every step of transition to the molars of the herbivorous antelope. Again, take the feet; note the difference between the great splay foot of the hippopotamus and the delicate hoof of the gazelle. The hippopotamus' foot is like the hog's; it is not difficult to see that the hog's is like the peccary's. Then there is a chain of resemblance from peccary to hyomoschus, to tragule, to steinbock, and finally to the sheep. The hoof of the horse can also be connected with the foot of the rhinoceros.

Another curious chain is that between bear and dog. Bears now differ from the canines in that they are plantigrade, and in the size of their tubular teeth, the last indicating their omnivorous diet. But in the tertiary epoch there existed amphicyons—plantigrade dogs with tubular teeth; these were replaced by the hyenarctos, more bear than dog. Then there is a hyena connection, for the cynodon links the dog and the civet. Of three species of ictitherium, found in Greece, one was half hyena half civet, one more civet than hyena, and one more hyena than civet. The relation of the lemur to the pachyderms is also strikingly shown in the fossils. Remains of small pachyderms have been found having monkey dentition, and M. Gervais has discovered an animal which he calls cebochœrus anceps, or, to use Patent Office parlance, combined pig and monkey.

THE SCIENCE OF PLAY.

There is not much obvious connection between the homely couplet "All work and no play makes Jack a dull boy," and Schiller's hypothesis of a "Spieltrieb," or sport impulse which he recognizes as existing in human nature, and to which he traces the origin of all fiction, and especially that of a poetic and dramatic character. Yet both ideas express truths which need but to be blended together, to bring before us a realization of the absolute necessity of play in a practical and physiological light. The first may be taken as referring to the physical gambols of the young animal; the second, to that which in one sense may be mental relaxation, in another, not so; affirmatively if the exercise of the sport impulse involves a total change of thought and idea, negatively if no such change takes place.

Play is an instinctive faculty, inherent in all animals. It is as much an instinct as the desire to seek food when hungry; and to regard it as a mere aimless and trifling species of exertion is a total mistake. The gambols of a child emerging from babyhood, or of a kitten, are due to precisely similar reasons. At this period of life the purpose of play in man and brute is the same; in after years the difference vastly widens through the introduction of the intellectual element in the actions of the child, and of course its total absence in those of the brute. The games and playthings of youth are not those of childhood; but the play of an old dog—though more rarely occurring—is nevertheless the same as that of a young puppy. The object of play in young life is exercise. It is the peculiar exercise which Nature prompts the organism to undertake; and it may be said that it is the only possible form of exercise which is at once attended by pleasure, and is able to mould the frame of the growing animal in the direction of its perfect development. Its antithesis is task work, which, though it may not involve one tithe the exertion, nevertheless passes quickly into fatigue, and thus results in straining some muscles unduly while others are left comparatively undeveloped. In play alone, the instinctive sense of physical need gets full scope; its spontaneity and aimlessness are therefore only apparent, and its nature and amount are determined by the sense of pleasure in the exercise itself; while on the other hand, a strictly natural limit is imposed on all undue exertion by obedience to the sense of fatigue. The result is an equable and harmonious development of muscular energy and nutrition in every muscle and fiber; and it is one attainable in no other way—certainly not by any prescribed routine of exertion—or save by obeying a natural instinct.

Dr. John Strachan, of Edinburgh, has recently published a valuable little treatise, physiologically inquiring into the bearing of play upon education and training; and after adducing conclusions substantially similar to those above enumerated, he proceeds further and states that the law of spontaneous development through play does not end with physical improvement, but that, after a time, the higher and more differentiated faculties come to be required for the perfection of the animal, and that the same law presides over their evolution. Play, he explains, that is apparently aimless, or, at least, not consciously directed exercise, is the means of securing the equable development of the brain and its faculties—memory, imagination, hope, wonder, and even special kinds of intellectual and moral activity, according to the endowments, and perhaps also the accidents, of social position in the individual. "Exercise is accompanied by pleasure up to the limit of fatigue; beyond this limit, by pain or uneasiness. Special endowments or faculties brought into prominence by accident and after exercised are more, others are less, developed. But in every case there is a limit, and the only sure way of ascertaining the limit is by giving scope to the instinct; in other words, by allowing 'play' or apparently unregulated and spontaneous impulse its due place in the work of education."

Of course the practical deductions to be made from Dr. Strachan's conclusions are, first, that tasks should never be arranged so as to carry the organism over the limit of fatigue, that play as such should be real play, nothing but the "absolutely free and spontaneous direction of the sport impulse," and not circumscribed by any limits as to kind or nature. Our author's treatment ends with the bearing of play upon the education and training of the young, else he might have pursued his inquiry further and reached the hardly avoidable conclusion that, as the human being grows older, play becomes more and more a mental process, until at last it becomes scarcely distinguishable from work itself. The labors of almost any professional man will demonstrate this; the results of his sport impulse viewed individually are due to what would to another man involve hard labor. Eventually play becomes merely difference in work, and involves the disuse of one set of tired brain molecules, as it were, and the calling into action of a fresh series, and the more different the labor the greater and more enjoyable, and doubtless the more beneficial the change. The author of that supremely funny children's story "Alice in Wonderland," and the wildly absurd "Hunting of the Snark," is a grave theological professor in a great English university—and both writings are productions which professional wits and humorists would shrink from attempting to rival. So, also, hard physical work presenting a still wider dissimilarity to mental labor becomes comparatively play. The ex-Prime Minister of England finds his greatest enjoyment in hewing down the trees on his estate. And we know of many an instance where an amateur's mechanical workshop adjoins the office of a physician or lawyer, or where the artist's easel furnishes the necessary play to a brain closely engaged in scientific study.

Specific Heat of Water.

According to new experiments by Munchhausen, of Moscow, the specific heat of water taken at unity at 32° is at 212° Fah. 1·0302, as against 1·013 found by Régnault, and 1·122 determined by Jamin. The investigations were made with the greatest refinement of accuracy.

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THE DUTIES OF THE COMMISSIONER OF PATENTS AND THE SUPERVISING POWERS OF THE SECRETARY OF THE INTERIOR.

SARGENT'S CASE.

Our readers will remember our notes on Sargent's case published in a previous issue: how, pending Sargent's application for letters patent for "an improvement in time locks," five interfering applications by as many different parties were filed; how each interference was decided in favor of Sargent; how one of these interfering applicants, namely, John Burge, filed a bill in equity in the Supreme Court of the District of Columbia, against Sargent, praying that the former might be adjudged entitled to a patent for the invention which had been the subject of the said interference; how the Commissioner of Patents, on application of Burge, suspended the issue of a patent to Sargent, until the final determination of the said equity suit commenced by Burge; and how the Secretary of the Interior, on the application of Sargent, reversed this order of the Commissioner. We are now enabled to lay before our readers the reasons upon which the decision of the Secretary of the Interior was based. These may be briefly stated as follows:

As an executive officer, the Commissioner of Patents has the authority to exercise such powers and functions as are conferred upon him by the statutes creating his office and defining his duties, together with those which may be prescribed in the rules and regulations adopted, with the approval of the Secretary of the Interior, to facilitate the business of the Patent Office. These duties are in part *quasi* judicial, and in part administrative, or ministerial and directory. In the discharge of his judicial duties, the Commissioner is to hear and determine the rights of the parties within the statute, governed by the same rules as a court. In the discharge of his administrative duties, whether of a ministerial or directory character, the law must be executed according to the letter and intent.

Letters patent for an invention are not to issue until the right thereto is clearly established, in accordance with the law and the rules and regulations of the Patent Office; but when this is done, and all of the conditions and requirements of the law, as well as the rules and regulations of the Office, have been fully complied with, they cannot be withheld. The duty of the Commissioner in this respect is clearly and explicitly defined in Section 4,893 of the Revised Statutes. If the applicant is adjudged to be entitled to a patent for the invention claimed, and has fully complied with the law and the rules and regulations of the Patent Office, in the payment of fees, etc., he is entitled to demand that the patent shall issue to him, and there is no right, legal or otherwise, which will justify withholding it. If there be an interfering claim, then it cannot be said that the applicant is "justly entitled" to a patent, until the issue raised by the interference is determined, in accordance with law and the regulations governing the Patent Office, although such applicant may have made an important invention and discovery, and would otherwise be entitled; but if after a fair consideration of such interfering claim, it be decided that he is entitled to a patent, his right is unchanged, and he may demand that the patent issue. This right is not affected by the words "*may* issue," in Section 4,904 of the Revised Statutes, which prescribes the course of procedure whenever an interfering application is filed; for the well settled construction of the word "may" in similar statutes is that it is the equivalent of "shall." Nor does the provision in Section 4,915 of the Revised Statutes, providing a remedy for the defeated applicant by bill in equity to establish his right to a patent for the invention claimed, authorize the Commissioner to withhold the issue of a patent, merely on the ground that a decision final in its character in one of the departments of the government should be held in abeyance to await the determination of the same question in a co-ordinate department of the government. Burge's suit in equity is a proceeding *de novo*, and is in no sense an appeal from the Commissioner's decision.

The above grounds, and the fact that all the interfering contests were decided in Sargent's favor, the Secretary of the Interior believes, warrants him in concluding that, at the time of making the order of suspension, there was no legal reason why the patent should not have been issued, and that there was no duty to be performed by the Commissioner except the ministerial duty of preparing and issuing the patent, and that in the performance of those duties the statute was mandatory.

In this view of the case, it became important to know what the duty of the Secretary of the Interior was in the premises. Had he the legal right to *direct* the Commissioner to issue a patent to Mr. Sargent? The Secretary of the Interior is satisfied that he has such a right. In the first place he is charged, by Section 441 of the Revised Statutes, with the supervision of certain branches of the public business, among which is "patents for inventions." By Section 481, it is provided that the Commissioner of Patents, under the direction of the Secretary of the Interior, "shall superintend or perform all duties respecting the granting and issuing of patents directed by law." Section 4,883 provides that "all patents shall be issued in the name of the United States of America, under the seal of the Patent Office, and shall be signed by the Secretary of the Interior, and countersigned by the Commissioner of Patents." The Secretary of the Interior is led to the conclusion that the supervision and direction with which he is charged means something more than an approval of the act of the Commissioner of Patents. That the responsibility of seeing that the work is properly done by the Commissioner of Patents is with the Secretary of the Interior; and that this duty of the latter relates to the negative as well as affirmative acts of the former. Thus, if the Commissioner neglects or refuses to perform any duty required by law to be performed by him under the direction of the Secretary of the Interior, or performs a ministerial or administrative duty improperly, the Secretary of the Interior, by virtue of his supervisory power, may direct him in its performance; for, to be charged with the responsibility of the supervision and direction of any kind of work or business, by law, and not be able to require that it shall be in accordance with the law, would be anomalous indeed.

In accordance with these views, the Secretary of the Interior directed the Commissioner of Patents to prepare and issue the letters patent for said invention to Mr. Sargent.

INFLUENCE OF THE SPINAL CORD ON BODILY TEMPERATURE.

Since the thermometer has been brought into active use as a clinical aid, numerous instances of unusual and surprising variations in bodily temperature have been recorded which could be ascribed to no other cause than a lesion of the nervous centers. No generally accepted theory explaining the phenomena is in existence; but it is at least conceded that of all the regions of the nervous system the spinal cord seems to play the chief part in these anomalous variations in animal heat. Some new investigations into the subject have recently been made by M. Parinaud of Paris, an account of which we find in the *Lancet*. He states that he was led to the inquiry by observing, in a case of fatal epileptiform convulsions, that the rise in temperature which occurred *pari passu* with the fits did not cease with the cessation of the fits, but continued to mount till death, which occurred six hours later, when it reached 108° F., and soon after death 110°. The experiments were made upon rabbits, and the results reached were that transverse sections of the spinal cord in the cervical or dorsal region led to a fall in the central temperature of the body, even when the surrounding air attained a heat of from 82·4° Fah. to 86° Fah. This lowering of the central temperature appeared to be due to the cooling of the paralyzed parts, the deep temperature of which remained during the whole experiment at a lower level than in the regions still under the influence of the spinal cord. But in the paralyzed parts there was a rise in the surface temperature of the extremities, probably owing to transient vaso-motor paralysis, as it passed away in time and depended for its degree upon the initial temperature of the skin and surrounding atmosphere.

M. Parinaud states his belief that the spinal cord influences animal heat by means of nerves distinct from the vaso-motor system, and which he imagines may have an action quite contrary to that set of nerves. At the same time, says the *Lancet*, he does not think it necessary to invent a distinct system of calorific nerves, but believes those nerves to be sufficient which regulate the processes of nutrition and secretion, of which calorification is simply the physico-chemical result.

AMATEUR OBSERVATIONS OF THE NOVEMBER METEORS.

On the 13th and 14th days of November, the earth makes its annual passage through the second of the great meteor belts which intersect its orbit. The thickness of this belt at its thickest part is estimated by Professor Proctor at some 100,000 miles, and it is supposed that the denser portion of the system or "gem of the meteor ring" contains at least one hundred thousand million meteors. These however, Herschel has calculated to be extremely small, rarely exceeding a few ounces in weight. It has further been determined that the November meteors mostly radiate from the constellation *Leo*, and the aphelion of their orbit is somewhat beyond the planet Uranus.

Late investigations have pointed to the identity of the orbit of some of the comets with the orbits of different groups of meteors. The path of the meteors, for example, which are usually seen from August 9 to 14, coincides with that of the bright comet of 1862, and both Peters and Schiparelli independently discovered some time ago that Tempel's comet of 1866—a body visible only with the telescope—has elements which may be regarded as absolutely identical with those of the November belt. It is not definitely known however, what connection exists between the comets and the meteors, though it appears that the latter have paths as eccentric as those of the cometic orbits, and hence it is deduced that the earth encounters no less than 56 meteor systems, thus affording proof that the total number of these systems in the universe must be estimated by billions.

It will readily be seen that a knowledge of the elements of the paths described by the meteors is of considerable astronomical importance. While, as already stated, the general direction or radiation is from the constellation *Leo*, it has been observed that often on the same night many distinct centers of radiation may be traced. It is by the determination of these centers that the elements above referred to may be calculated. Then by comparing the results with the elements of the orbits of known comets, it becomes possible to discover which comets, by rupture, according to one theory, probably gave rise to the various groups of shooting stars. Hence observations made with the naked eye, which fix the exact point in the heavens whence the meteors appear to radiate, may prove of value.

It is necessary first to note the region of the heavens whence the meteors appear, and then to observe specially those bodies which seem to have the shortest trajectories. These will, of course, be the ones nearest the center of radiation, and in this way the location of the latter can be quite accurately determined. Look also for a pale light something similar to the aurora, which is often present about the radiating point. It is also useful to note the color and brilliancy of the meteors. The latter may be estimated by comparison with Jupiter and Venus, the brilliancy of these planets being taken as the maximum. If the meteors leave a trail behind them, note the fact, and also observe how long the trail remains visible after the star disappears, also whether it has any backward motion. A field glass may be advantageously employed to recognize any special peculiarities of the trail. These observations, if carefully made, will be acceptable at any astronomical observatory. Meteors also appear from the 27th to the 29th of November, and from the 6th to 13th of December, but not in such numbers as upon the above-mentioned dates.

ANOTHER TRAVELING EXPEDITION.

A scheme has been started in England which differs from the Woodruff scientific expedition in that, while the latter subscribers pay $2,500 and travel themselves while somebody else makes money, in the other they pay $500 and don't go, but then they make the money out of other people who do. The name of the concern is "The Hadjik or Pilgrimage to Mecca, Syndicate, Limited," and its object is the benevolent purpose of transporting devout Mahometans to the aforesaid holy city. There is a glowing prospectus, picturing the delights of the trip, which estimates that at least 170,000 pilgrims will go to Mecca this year, and if each one of these can be made to come back under the company's auspices at an average of 35 dollars per head, this "would place at the disposal of the syndicate a gross sum of nearly six million dollars," of which one million seven hundred thousand will be clear profit plus also gains by freight, etc. There are only 100 shares at $500 each, and consequently it appears for investing the above sum, the subscriber is going to make at least $17,000. Our British cousins evidently know more than we do regarding the financiering of traveling expeditions.

IMITATION TERRA COTTA.

The *Magasin Pittoresque* gives the following original recipe by which it is stated plaster casts may be made to imitate terra cotta ware with great fidelity. The following colors are necessary, brick red, lamp black, zinc white, and yellow ochre, all in powder. The object to be treated is first carefully rubbed over with "0 0" sand paper so as to remove all roughness of the surface or ridges indicating where the parts of the mould have been joined. The mixed color consists of yellow ochre 2 parts, brick red 2 parts, and black 1 part. These are well rubbed together. Then 3 parts of zinc white are separately mixed with a little milk to a paste. All the ingredients are then combined in a mortar with 8 or 10 parts of milk and the resulting mixture is passed through a fine sieve to remove any particles of the white. A soft brush is then used to spread the stain over the object, care being taken to lay it on evenly. After 24 hours drying a second coat is applied. When the article is completely dry, rubbing with the finger will eliminate brush marks.

Russian Remedy for Hydrophobia.

A correspondent in *Land and Water* gives the following Russian remedy for hydrophobia: In Saraton the inhabitants collect the larva of the rose beetle (*cetonia aurata*) which are chiefly found in the wood ants' nests. The grubs are gathered in the spring, placed in earth, and their change or metamorphosis watched for. When this takes place, they kill the beetles and dry them. The powdered insect must be kept in hermetically sealed bottles, or the dried beetles may be kept in sealed pots and reduced to powder when wanted. Three beetles, powdered, is considered a dose for an adult, given immediately after the bite. One for a child and five for an adult in which the disease has declared itself. The effect is to produce a long sleep, which must not be interrupted. The bite is also treated surgically.

The beetles caught on flowers are not so beneficial; they must be secured in the larva stage, and killed directly after they attain the image. Some of the Russians give their dogs occasionally half a beetle as a preventive.

Ancient Mode of Moving Large Stones.

M. Eugene Robert, having found in the neighborhood of a Keltic dolmen in France a ball-shaped mass of sandstone about a foot in diameter, suggests that it might, with other stones shaped like it, have been used as a roller to facilitate moving the immense masses of rock wherewith the ancients constructed their monuments. He thinks that by this means the large granite rock which supports the equestrian statue of Peter the Great in St. Petersburgh, was brought from Finland.

DEATH FROM CHLOROFORM AVERTED.—A correspondent of the *British Medical Journal* communicates the interesting observation, that in a case of syncope during the administration of chloroform, where the usual treatment was without effect, and death seemed imminent, the application of some lint saturated with nitrite of amyl to the nostrils was followed almost immediately by restoration of the pulse, and the subsequent recovery of the patient.

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[*Continued from first page.*]

off in jerking the hawser, but, as subsequently proved, a large and hard stone had cut through the iron skin forward of the end bulkhead, and since (as usual) the doors of the different bulkheads had been left open, the whole vessel was filled with water. A timber crib about 9 feet square was then filled with old rails and stones. This was hauled forward against the cylinder by a chain attached to it and passing under the cylinder, and with the help of a couple of hydraulic jacks working on the top of the crib the cylinder was once more in a few hours rolling seawards. As soon as the bottom plates came to the surface a patch was secured over the hole made by the stone, the vessel was pumped dry, and it only remained then to recall the tugs and let them haul off the ship, which they easily did. This obelisk will be erected in some prominent locality in London.

According to the New York *World*, the Khedive of Egypt has offered to present a monolith similar to the "needle," to the City of New York. The shaft now stands erect and is some seventy feet high. The English contractors who are now transporting the English stone are said to have offered to transport the Khedive's gift to this city, and to erect it in any location which may be chosen, for $100,000. It is proposed that this sum be raised by subscription among the citizens of New York.

A NEW ACID.—A new acid of phosphorus and oxygen has been discovered by Herr Salzer, of Worms. According to the old notation it consists of one atom of phosphorus and four atoms of oxygen. It has been named hypophosphoric acid.

IMPROVED DOUBLE SHEDDING HARNESS JACQUARD LOOM.

The annexed illustration of Ainley's double shedding harness jacquard loom, as manufactured by Messrs. Hutchinson, Hollingworth & Co., Dobcross Iron Works, Saddleworth, England, we copy from *The Textile Manufacturer*, with description of the chief movements employed. The first point which it is necessary to direct attention to is the fact that the jacquard machine is altogether independent of the general framework of the loom, being fixed upon beams at a proper elevation. This is a great advantage, since it avoids a very large amount of vibration to the jacquard. The double shed is produced as follows: The main lever at the left hand side, working upon a central fulcrum fixed to the top rail of the loom, is the common medium of motion. This is actuated in the ordinary manner by the shell wheel below, making one motion for each pick, precisely as the common loom.

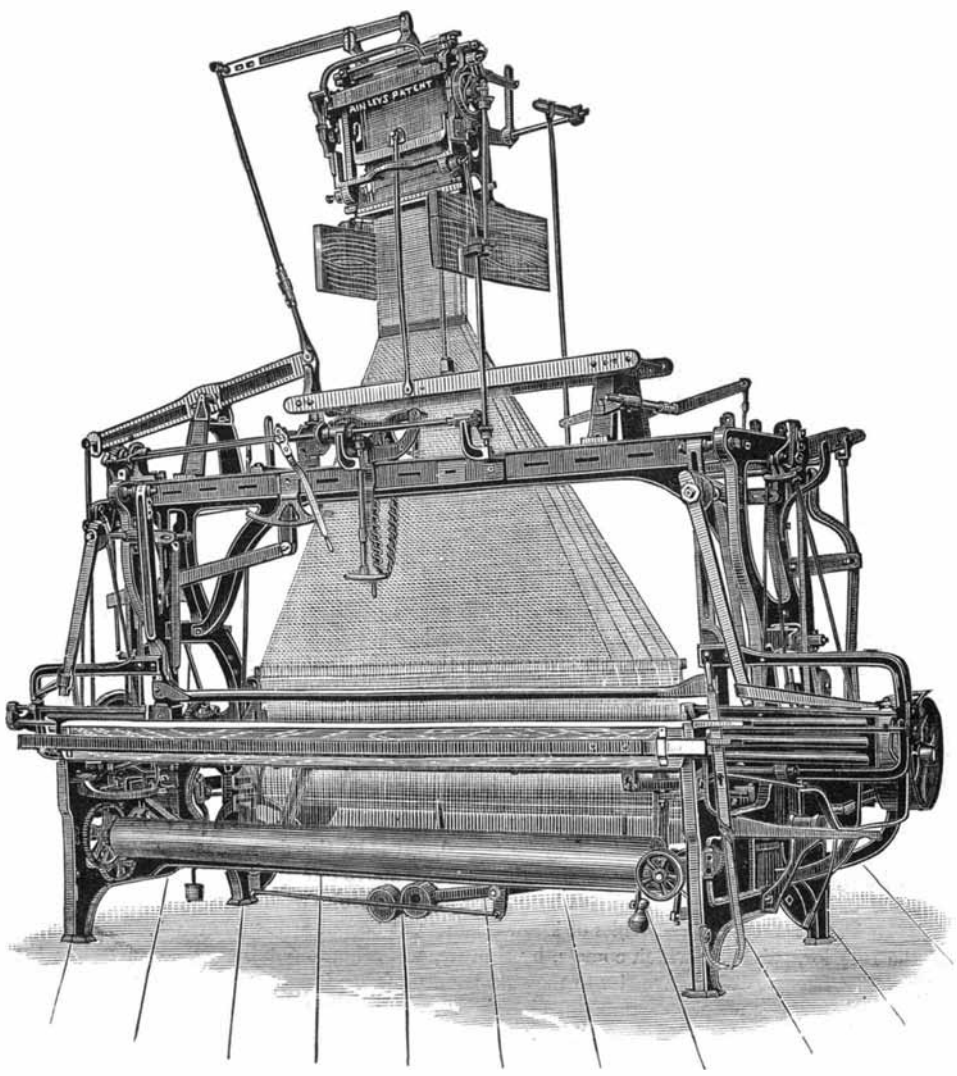
Connected with this are the other horizontal levers, one above and the other below the jacquard machine. The lever above lifts such hooks as are selected by the pattern card to be raised. The remaining hooks, supported on the descending footboard, are brought down by the other lever at one and the same time; the descending footboard being connected to the horizontal lever frame by two upright rods, one in front of the harness and one behind.

The rod shown at the right hand, from the top of the loom up to the jacquard, is for the purpose of opening and closing the card cylinder, and is worked by an eccentric on the main shaft of the loom. The rotary motion to the card cylinder is communicated by the upright shafts connected by bevel and pinion wheels with the picking and box motions in such a manner that on turning the loom either backwards or forwards the whole of the motions relating to pattern cards, shuttles, boxes, and picking are kept in their correct relative positions, an advantage which will be fully appreciated by the practical weaver.

Another great advantage is obtained by the graduated hooks and the harness tied in a beveled instead of level position, whereby the back part of the shed opens first, and consequently opens to a larger extent than the front part, thereby giving a greater and clearer space for the passage of the shuttle.

It will be at once noticed that, as the hooks in lifting have only to move half the distance of the shed required, the motion is very steady and the friction reduced to its lowest point; greater facility thus being given for speed, wherever that is desirable, combined at the same time with a perfection in the work otherwise unattainable.

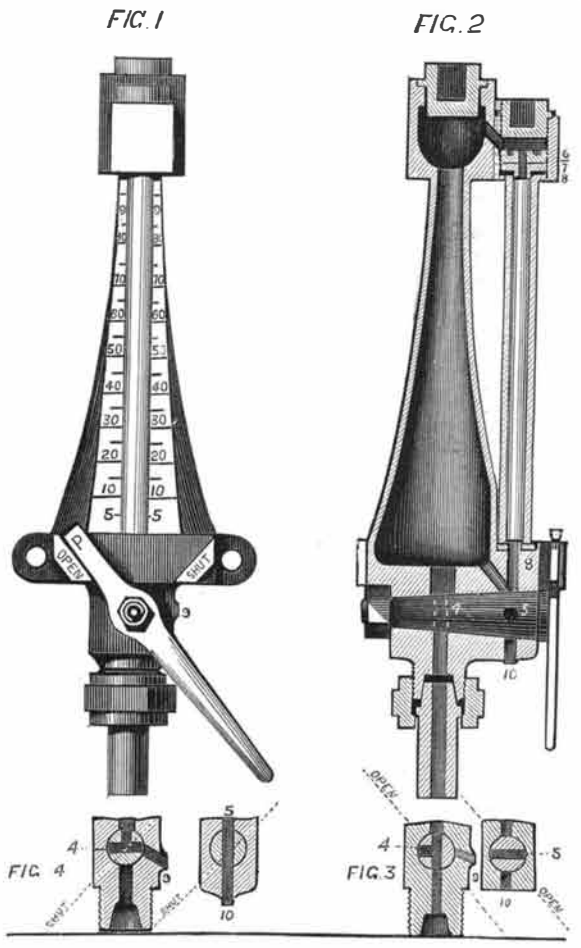
Another lever fixed on the left hand of the loom under the top rail is, by a catch arrangement, brought into action when the sheds are very variable in weight, as, where one or more picks of weft are upon the surface of the cloth, and the next on the back of the cloth. This lever, with a weight attached, is lifted with the light shed, so as to enable the loom to bring back with ease the large portion of the descended shed, thus equalizing the working motion of the loom under any varying circumstances.



AINLEY'S DOUBLE SHEDDING HARNESS JACQUARD LOOM.

ALLAN'S PRESSURE GAUGE.

We illustrate from *The Engineer* an improved form of the Allan gauge, as simplified by Mr. Alexander Allan, Jr., of



Scarborough, England. The principle on which this gauge works consists in indicating pressure by the compressed condition of a measured volume of air within the gauge tube; this is acted upon by water—condensed steam—as a piston, contained in a bent pipe attached at one end to the gauge, and at the other to the boiler or vessel whose pressure is to be indicated. The gauge is a hollow pillar of brass of a differential internal capacity, connected by passages at top and bottom to a glass tube in which the surface water line indicates the pressure opposite a graduated scale. There is, as we have said, but one cock on the gauge worked by a handle with pointer, P, moved over a quarter of a circle only between two stops. The pointer, P, at "open" is open to the boiler to show pressure, and at P is "shut" for admitting a new spring of air into the gauge by apertures opened to the atmosphere. On the lower part is the usual screw union for connecting the gauge with the steam space of the boiler, by the exposed bent pipe, which will collect clear water by condensation. In order to work the gauge it is necessary to begin with the pointer, P, at "shut;" the exposed bent pipe will soon condense steam to give a supply of water, which will be known by the reduced temperature of the pipe. When sufficient water has been collected in the bent pipe, the pointer is turned to "open," when the water will rise until its level shows the pressure. The first indication may not be correct from the presence of some air in the bent pipe over the true measure; by again turning the pointer, P, to "shut," the incorrect spring and water will leave the gauge and a new spring of air will be admitted. On reopening the cock the true pressure will be shown in the glass tube opposite the index. With a supply of water in the bent pipe this test or correction can be repeated hourly, but it is not necessary to change the air spring for months.

In the accompanying engraving, Fig. 1 is a front elevation of the gauge, showing the glass tube, part index on pillar, stops "open" and "shut," handle and pointer, P, at "open" to show pressure; Fig. 2 is a side elevation in section showing passages connecting the gauge with the glass tube, the nut, 5, washer, 7, india rubber rings, 8, cock and passage, 4 and 5, and the position of 5 to 10, with pointer, P, at "open." Fig. 3 gives end sections of cock and plug at 4 and 5, in the plug, to 9 and 10, with the pointer, P, at "open;" the angular line shows the direction of the handle and pointer, P; Fig. 4 gives similar sections, and shows the position of the passages, 4 and 5 to 9 and 10, changing the air spring, and the angular line showing the direction of handle and pointer, P, at "shut."

This simple and ingenious gauge deserves more notice and popularity than it has received. The old Allan gauge has been worked with great success for many years, and the new gauge is much better in every respect.

Simple Tests for Flour Adulterations.

Dr. Himly, Professor of Chemistry at the University of Kiel, has suggested a method by means of which any person of ordinary intelligence may test the amount of adulteration of flour. It is based upon the fact that chloroform is specifically lighter than nearly all the substances usually employed for these adulterations, such as lime, chalk, barytes, plaster, marble, bone-powder, etc., while the genuine flour is again lighter than chloroform, in which none of the above named substances are soluble. The testing process is simple, and all the apparatus required is a small test tube about ⅜ inch in diameter, and 4 or 5 inches long. A teaspoonful of the flour to be tested is placed in the test glass and chloroform poured on to fill the vessel to about three quarters of its length, when it is well shaken, and then placed in a upright position, so as to remain undisturbed until the various substances mixed together have had time to find the level assigned them by their specific gravity, the flour swimming near the surface at the top of the vessel, while the mineral bodies will sink to the bottom. It should be observed that unadulterated flour often shows a slight filmy deposit of a grayish or brownish color, which it must be supposed is stone-dust, produced in grinding. A white deposit, however, will invariably indicate an adulteration with one or another of the substances mentioned above. If the materials are weighed before and after separation, the amount or degree of adulteration may be pretty accurately ascertained.

Artificial Ivory.

L' Union Pharmaceutique gives the following recipe for making artificial ivory: Two parts of caoutchouc are dissolved in thirty-six parts of chloroform, and the solution is saturated with pure gaseous ammonia. The chloroform is then distilled off at a temperature of 85° C. The residue is mixed with phosphate of lime or carbonate of zinc, pressed into moulds and dried. When phosphate of lime is used the product possesses to a considerable degree the nature and composition of ivory.

An Immense Block of Granite.

There was recently quarried without the use of powder, at the Barre granite quarries, for the use of the Oliver Granite Works, of Rutland, a block weighing about six hundred and eighteen tons, being forty feet long, seventeen feet high, and ten feet thick. This immense stone is said to be perfect in every respect, and is believed to be the largest block of granite ever quarried in the State.—*Rutland (Vt.) Herald.*

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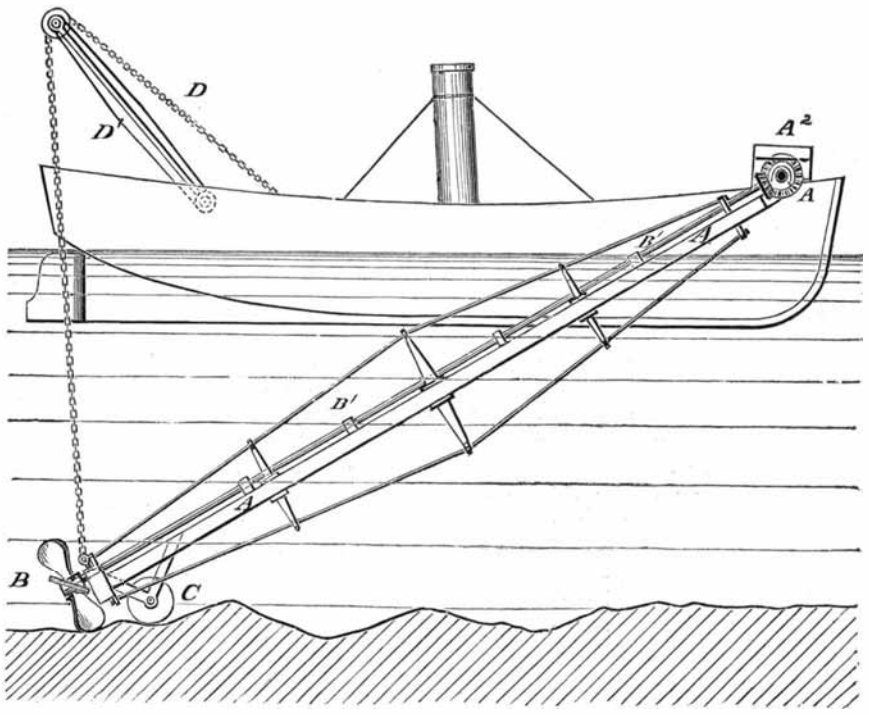
A NEW DREDGING APPARATUS.

In the dredging apparatus represented in the engraving, propellers driven by suitable motive power work partially in the material or sand bank to be removed, so causing whirlpools and bringing the mud or sand into a state of suspension in the water, where the current washes it away. The propellers are carried at the ends of beams, which, at their opposite ends, are hung to a lateral frame of a barge or vessel. The ends of the beams carry back of the propellers rollers to run upon the mud or sand, and prevent the propellers and beams from entering too deeply into it.

In the engraving, A A are the beams, of suitable construction and length, that are hung at the upper ends to a shaft A^1, that is supported in bearings of a lateral frame, A^2, of a suitable barge or vessel, and driven by a steam engine on board of the same. The driving shaft, A^1, revolves, by beveled gear wheels, the shafts, B', that turn in bearings of the beams, and are provided at their lower ends with a propeller or propellers, B. Each propeller or stirrer, B, consists of a four-bladed screw of unusual strength, with two blades set in advance of, and being somewhat longer than, the other two. The propellers are lowered to the bottom of the river or canal, or other water courses, and then revolved to work on the sand bank or material to be removed, so as to stir up the same and bring it into a sufficient state of suspension in the water to admit of its being carried away by the current. A roller or rollers, C, are arranged back of the propellers, turning in suitable bearings of the beams, A, to prevent the propellers from entering too deeply into the mud so as to break or get stuck.

The propellers and beams are lifted by means of chains, D, and crane, D', into position alongside of the vessels, when the work of removing the sand is to be interrupted, the propellers serving then to move the vessel.

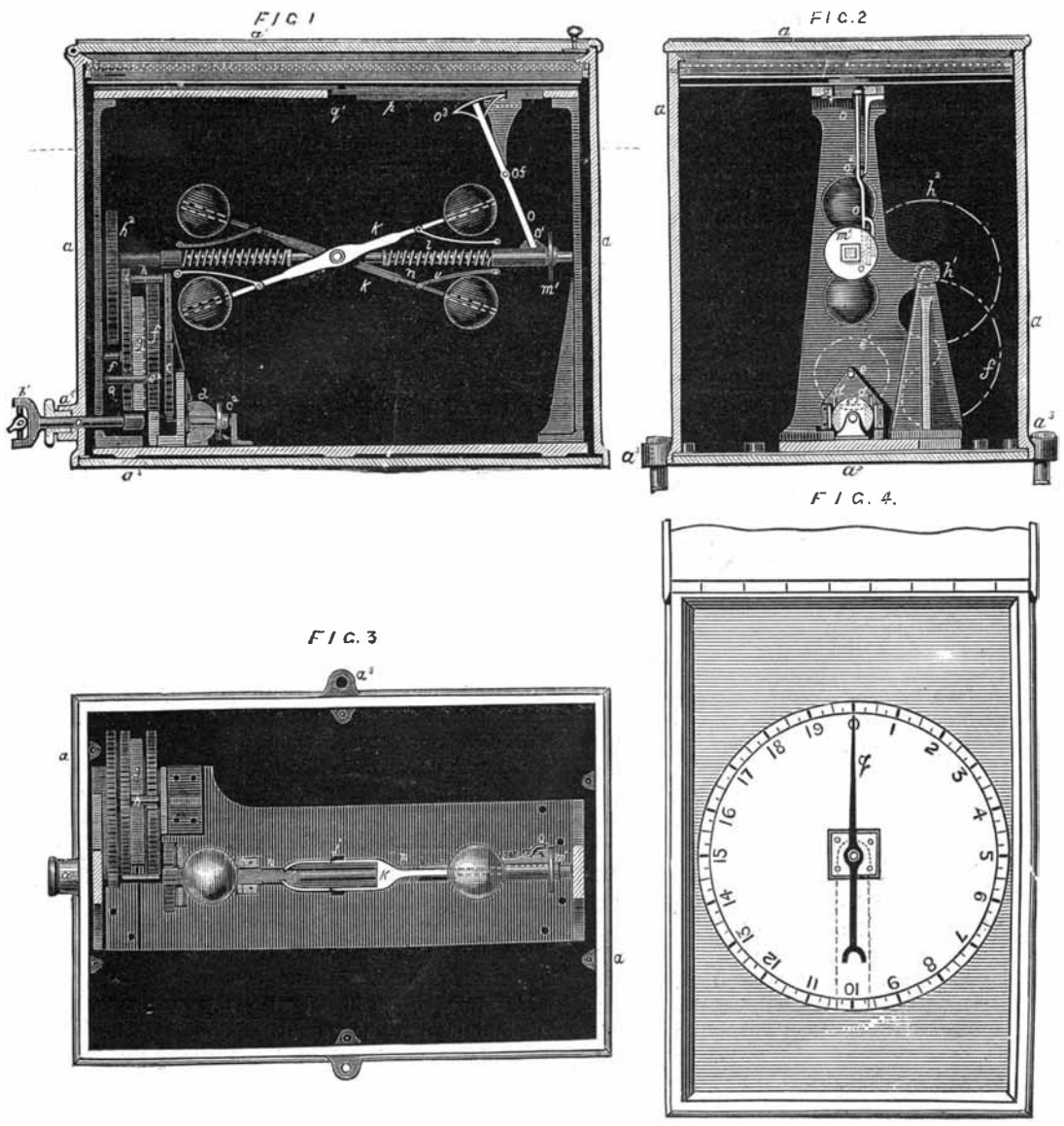
This invention was patented through the Scientific American Patent Agency, November, 7, 1876, by Messrs. J. J. Van Rietschoten and W. Houwens, of Rotterdam, Netherlands.



DREDGING APPARATUS.

IMPROVED SHIP'S SPEED INDICATOR.

We illustrate, from *The Engineer*, a ship's log or speed indicator, patented by Mr. W. de Normanville, of Bridge-road, Hammersmith, England. Fig. 1 is a longitudinal section of the apparatus; Fig. 2 is a transverse section: Fig. 3 is a plan with some of the parts removed: and Fig. 4 represents separately the dial and index. *a a* is the case of the instrument; it is constructed of cast iron, and is provided with a hinged lid, a^1, immediately beneath which there is a plate of stout glass secured in a watertight manner. Lugs are provided, by which the instrument is secured to the rail of the ship or vessel; a^4 is a stuffing box in the side of the case to receive a spindle, *b*, carrying a universal joint, b^1, through which the connection with the rotator is made; a^5 is a screw plug in the bottom of the case, which, when taken out, leaves a hole admitting of the introduction of a turnscrew to insert or remove the small screw pin, b^2, by which the spindle, *b*, is held in a socket, c^1, at the end of the axis, *c*. The frame which carries the axis, *c*, and the other working parts of the instrument is fixed to the bottom, a^2, of the case, so that the whole of the mechanism comes out with the bottom when that is removed; c^2 is a disk on the axis, *c*; it bears against friction rollers, *d d*, mounted on the frame so that the axis may revolve freely, notwithstanding the strain to which it is exposed in towing the rotator through the water; c^3 is a pinion on the axis, *c*; it drives a wheel, e^1, on an intermediate axis, *e*, on which again is a pinion, e^2, driving a wheel, f^1, fixed on an axis, *f*; f^2 is another similar wheel on the same axis, but able to turn upon it. It is fixed to the spring box, *g*, in which is a coiled spring, having one end fixed to the axis and the other to the interior of the spring box. This arrangement constitutes a regulating apparatus: the spring, being wound up by the action of the rotator, is the maintaining power driving the indicating instruments, to which it imparts a regular velocity free from sudden changes. The wheel, f^1, drives a pinion on the axis, *h*, on which is also a spur wheel, h^2, gearing with a pinion on the main axis, *i*. In the middle of the axis, *i*, is a pin, which serves as an axis for the two weighted arms, *k k*; they have weights at their ends arranged so that the divergence of the arms is not affected by the pitching of the vessel. *l l* are links connecting the arms, *k*, with the sliding collars, *m m*. When the instrument is in use the centrifugal action of the weighted arms compresses the springs, *d n*, more or less, according to the speed of rotation. On one of the collars, *m*, there is a disk, m^1, against which a friction roller, o^1, carried by the lever, *o*, bears. The lever, *o*, carries at its upper end an arc, attached to which is one end of the fine chain wound round a barrel at q^1, on the axis on the index. *r* is a light spring surrounding the axis, q^2, and attached to it at one end, while the other end is fixed to the frame; it serves to hold the index back against the action of the lever, *o*, to keep the chain, *p*, always tight, and to hold the roller, o^1, against the disk, m^1. The dial is graduated to indicate the speed of the ship in knots per hour. The prime motor of this instrument is a small screw or rotator similar to that used in other logs, drawn after the vessel by a line some 150 feet in length. The shaft of the rotator is about 12 inches long by about 1 inch in diameter, made of such specific gravity that if left to itself it would slowly sink, but it is easily kept up by the line to which it is attached, drawing it through the water, some 8 feet below the surface. This rotary motion of the screw is conveyed by the line to the rest of the mechanism.



NORMANVILLE'S SHIP'S SPEED INDICATOR.

A New Autographic Process.

Autography is a long known process by which manuscript, or drawings, made on common paper by means of a peculiar kind of ink, may be transferred to a lithographic stone and then printed.

A new method, which is said to be both simple and cheap, is described by Professor G. O. Sars, of the University of Norway, in the *American Journal of Science and Arts*. The drawing is done on common letter paper, which, on one side (where the drawing is to be made), has been coated, by means of a sponge, with a thin film of starch. As it is not well for the shading to use quite glossy paper, it is a good way to give it a granulated surface by pressing it against a lithographic stone. By using for this purpose stones with more or less smooth surface, the paper will assume any degree of smoothness required, according to the character of the drawing. The next process is to fasten the paper to a sketching board or a piece of pasteboard; the drawing is then made by means of the lithographic crayon.

The paper must be cut to the size intended for a full plate, and the drawings arranged in the same order as they will have to appear in the printed plate. The method is the same as in common drawing with lead pencil, or rather crayon. The figures should, however, first be sketched in outline on common paper and then transferred to the prepared paper in the usual manner, by means of transparent paper and plumbago paper, blue paper, or, still better, red paper, the transferring being done with a lead pencil that is not too soft. The details of the figures, the shading and finer structural conditions, may be drawn off-hand with the crayon on the prepared paper, after the outline has been transferred. Any correction or change in the drawing can easily be done by erasing with a fine scalpel, taking care only that the starch film be not injured. When the plate is finished to satisfaction, it is transferred to a common smooth lithographic stone, in the following simple way: The back of the paper is moistened with water containing a small portion of nitric acid; and, after having been put for some time between moistened soft printing paper, the plate is laid, face downward, on the stone, which then for a moment is put in the press. To make more sure of it the outside of the paper may be slightly rubbed with the finger; if then the paper be stripped off, the drawing and the entire film of starch will remain on the stone, the figures being reversed. Now the stone is to be treated in the common way with gum arabic and a weak etching, and will then be ready for printing. The whole process of transferring the drawing from the paper to the stone is simple, but requires practice and great care. This should, therefore, be left to the charge of a professional lithographer. This process is especially well adapted to the uses of zoölogists, microscropists, and naturalists generally, as it enables them to prepare their own illustrated plates at minimum expense.

Potato Bug Cure.

Many different means have been tried to destroy the beetle, but without effect, until the present method was found, and this method is so effective and so cheap, that he must be a very careless farmer who still lets his potatoes be ruined. It is the following: Take 10 lbs. of lime and mix it well with 1 lb. of Paris green, which is in no way deleterious to the potatoes, giving 11 lbs. of mixture for each acre. Get a small wooden box, 10 inches by 8 inches, and 6 inches deep, and nail a piece of millcloth, as used for sifting by wheat millers, instead of a wooden bottom beneath, also a piece of lath across the middle of the open top as a handle for shaking the box. Every morning from 5 to 9 o'clock or longer, as long as the dew is on the plants, this mixture has to be applied. Children of 8 to 12 years can easily do it, by putting about one pint into the box and sprinkling it as dust by slow shaking on the leaves of

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the plants. I guarantee that if this is done at the beginning of the growth in spring, as soon as the first insects are seen, the plants will remain perfectly free. Within two days all the beetles will have disappeared, and this result is quickly arrived at, even if the field has been real ady completely devastated, and only the stalks remain covered with the insects and their larvæ. The cure never fails, and it has already been proposed by our farmers in the papers to compel all potato growers by law to apply this mixture on all their fields, for then, within two years, the bug would be entirely destroyed.

Distillation of Crude Petroleum.

The crude oil to be treated is first placed in large settling tanks, to allow the subsidence of any water intermixed. It is next pumped into large upright cylinders, or stills, holding about 12,000 gallons, and these are generally heated by steam alone. In the iron worms proceeding from the still cupola and surrounded by cold w:ter, the various grades of naphtha, constituting about 15 per cent of the crude oil, are condensed, *seriatim*, and conducted to separate tanks.

The crude oil remaining in the naphtha stills is then pumped into stills heated by direct fires underneath. These charges are distilled to coke, which remains in the stills, or to a thick residuum, which is drawn of and used in making fertilizers, etc. The uncondensable gases pass into the atmosphere, and the oils are condensed and separated into crude burning oil, intermediate oil, and crude lubricating oil. Each of these products is redistilled, and the distillate from each separ:ted, as before, into lighter, intermediate, and heavy oils.

Number one from this second distillation is thoroughly agitated with strong sulphuric acid, and then with a solution of caustic soda. It is afterwards redistilled, and yields about 80 per cent of finished kerosene and mineral sperm oil, and nearly 20 per cent of dense oils, from which solid paraffin is obtained.

It was in the agitator described, and after the second distillation, that the strange fire occurred, as recently mentioned in the SCIENTIFIC AMERICAN, at Hunter's Point. Most probably the usual quantity of 5 per cent of sulphuric acid had been added to unite with the remainder of the lighter products, and those substances causing the unpleasant odor of crude or partially crude petroleum. The important question here arises: Does the inattention or ignorance of workmen ever allow an undue quantity of the dangerous hydrocarbons to pass into the agitator, there to come in contact with great heat and strong chemical action? We know but too well that there is scarcely a manufacturing process of any kind that is free from such irregularity, and in extensive refineries the impossibility of managers being always at hand, and the necessary frequent engagement of new hands, might easily occasion such a difficulty and such an opportunity for unexpected chemical combinations.

It has been already stated that there is doubt as to whether it was a stream of cold water or a jet of steam which was turned into the agitator. It is much more probable that it was steam than water, because one of the first efforts in the distillation is to get rid of all water in the oil, and many refiners, I am informed, blow steam at high pressure through the crude petroleum, to aid in eliminating the naphtha, before the oil is run into the fire stills. Whether steam thus introduced is a safe process, or whether unlooked-for circumstances may not develop a danger always slumbering amidst such violent action, is a ques.ion for grave consider:ation. In the case in point I do not know whether an excess of the lighter hydrocarbons were allowed to enter the agitator, but if it were so, and high pressure steam admitted —and there could also be too much pressure and heat for safety—danger might well be feared, although it, like an impending steam boiler explosion, might long be averted.

In the lighter and more dangerous hydrocarbons the quan:ity of carbon ranges from 89·55 to 92·31 per cent, and hydrogen only 7·69 to 10·45 per cent. As the chief danger from fire is known to arise from these lighter products, it is evident that the carbon in them, and not the hydrogen, is the dangerous substance. Carbon, as is well known, cannot inflame except by the presence of oxygen, and it is reasonable to believe that, when oxygen in steam is vastly expanded and attenuated by the heat which has put it into the form of steam, and when the latter is brought into contact with a substance so rich in carbon—the latter also much ele vated in temperature and expanded by the admixture of sulphuric acid—there are furnished additional facilities, so to speak, of combination between the oxygen in the steam and acid and the carbon of the lighter products, if the latter exist in too great proportion. There would then be mechanical division of oxygen (by expansion through heat), to promote chemical action, the latter at the same time varying, in an unknown ratio, to the heat equivalent, and to the quantity of carbon unintentionally introduced by the lighter products.

Besides this danger from the ignition of fumes of naphtha, already mentioned, there may be a danger from the sudden evolution of electricity, which is sometimes generated in large volumes in the most unexpected manner. Should this happen, the chemical combinations I have been considering might be hastened, or made at untoward times. Two volumes of hydrogen and one of oxygen, if placed in a tight vessel, can be condensed into water, with explosion, by the passage of an electric spark, with the production of a great amount of heat. Perhaps, in a similar manner, electricity, suddenly evolved, might cause instantaneous combination of the oxygen in steam or water with the carbon of certain of the petroleum products—the heat consequent upon such combination inflaming the whole of the oil.—*American Exchange and Review.*

The Electric Light at Sea.

The Téméraire, eight, 8,412 tons, 7,000 horse power, Captain M. Culme-Seymour, ironclad double turret ship, having been fitted with the electric light, a number of experimental trials were lately carried out on board in the repairing basin, Chatham dockyard, with the object of enabling the authorities to be satisfied as to the official working of the light previously to the vessel taking her departure from this port for the Mediterranean, which she will do in the course of a few days. The electric lights on board the Téméraire, as is also the case in the Alexandra, are fitted in a commanding position of the ship; and during the trials, which were carried out under the supervision of the Admiral-Superintendent of the yard, C. Fellowes, C.B., and other officials, every portion of the vessel was vividly lighted up, while for a distance of several hundred yards around the ship the minutest objects on the surface of the water and the land were clearly discernible. Indeed, so powerful was the light that during the experiments the houses and buildings in Chatham and Rochester, including Rochester Cathedral and Rochester Castle, a couple of miles distant, were brought out into full relief, and were clearly discernible as the rays of the powerful electric light were directed towards them. The crucial trials, which lasted some time—the night being exceeding favorable for the experiments—were considered to be exceedingly satisfactory, and it was the unanimous opinion of all who witnessed them that the Téméraire possesses in the electric light a most powerful auxiliary in enabling the presence of torpedoes and other obstructions, as well as the positions of any vessels, hostile or otherwise, to be readily and clearly ascertained, although some miles distant. The electric light apparatus on board the Téméraire and the Alexandra having proved such a valuable acquisition to those vessels, the Admiralty has now directed the contractors to put similar apparatus on board the armor plated turret ship Dreadnought, which is now fitting for sea at Portsmouth.

Compound Locomotives in France.

M. Mallet has submitted a report to the French Academy of Sciences relative to three compound locomotives recently built at the Creuzot Works for the railroad between Bayonne and Biarritz. There are two exterior cylinders acting relatively at right angles. Ordinarily the smaller cylinder first receives the steam, and the latter then passes into the larger cylinder in the usual way; but when the engine is started, or when a heavy grade is to be surmounted, a special valve arrangement allows of the steam entering both cylinders directly from the boiler, so that the engine works no longer on the compound principle.

The locomotives weigh from 19 to 20 tons each. The two cylinders are respectively 9·3 and 15·6 inches in diameter, with a uniform stroke of 17·5 inches. The four wheels, coupled, are 46·8 inches in diameter. The boiler has 481·5 square feet heating surface.

The road from Bayonne to Biarritz is 4·8 miles in length, and has a grade over 1·8 miles of ·015 to 1. The locomotives have traveled over 24,000 miles in all, and the results obtained are highly successful. There was no lack of stability even when running at 24 miles an hour, a high speed for wheels of such small diameter. With regard to expenditure of fuel, the gross amount was 148 lbs. of Cardiff coal per mile—the weight of the train being from 40 to 75 tons, exclusive of the locomotive.

More Satellites to be Discovered.

M. Wilfred de Fonvielle writes to the London *Times* to point out that the number of the satellites of the heavenly bodies probably varies in geometrical progression, of which the ratio is two for the great planets from the earth. Thus we have but one moon, Mars twice as many—two; Jupiter twice as many as Mars—four; Saturn twice as many as Jupiter—eight. It may be supposed, according to this, that Uranus has twice as many moons as Saturn—sixteen, and consequently that Neptune has thirty-two—it being impossible to see these owing to the immensity of distance from the earth. M. de Fonvielle also states that M. Frederic Petit, of the Observatory of Toulouse, advocates the existence of a a second satellite of the moon, which he believes he has seen several times. If the diameter of the satellites of Mars is as small as reported, such bodies could easily revolve round the moon unnoticed by astronomers on the earth, and their presence might account for some of the known irregularities in the moon's motion.

Specific and Melting Heat of Platinum.

M. Violle states that the quantity of heat yielded by 15·4 grains of platinum from the melting point to 59° Fah.—the average temperature of the calorimetric liquid in the experment—is 166·4°. The temperature of fusion of platinum is 3234·2°, but the increase of specific heat of the metal with the temperature is accelerated, doubtless, in the neighborhood of the fusing point, the platinum passing through a pasty state before becoming liquid. The true temperature of fusion should therefore be somewhat less than the number thus obtained. The latent heat of fusion of platinum is 80·8°. The melting point of silver is 1749·2°.

The Horse's Back.

The first thing to observe in judging of a horse, so far as his back is concerned, is the length of it. A long back is a weak back the world over, and in every instance. By superior excellence of structure in other respects, the weakness of the back may be, in some measure, made up; but the horse can never be the horse he would have been had his back been a shorter one. We do not care how short a horse's back is; for it is a sure evidence that he can carry or drag a heavy weight a great distance, and not tire; neither, if he be speedy, will two or three seasons of turf experience break him down, as is the case with so many of our speedy, long-backed horses.

Old Morrill and Flora Temple are instances in the past; and the famous grandson of Old Morrill, Fearnaught, and Taggart's Abdallah, are good illustrations among later horses. This conformation of the back was, in our opinion, a grave objection against Young Morrill and Rysdyk's Hambletonian. In spite of all their excellence both of them would have been decidedly better horses had they been coupled shorter and more strongly on the back. If Young Morrill had had the back of his sire—one of the most marvellous specimens of perfect bone structure and muscular power ever bred—he would never have gotten so many swayed-backed colts as now stand to his charge. The same was the case in even greater measure with Rysdyk's Hambletonian. We know what he did in the stud. We know that, crossed on mares of a certain pattern and blood, especially on the daughters of American Star, the son of the great Henry, he gave us trotters of the highest speed, and second to none in endurance. But all this was true in spite of his back, not because of it; and where he sired one colt closely and strongly coupled up in the back and loins (as every colt should be) he sent forth five or ten without this admirable construction, nay, representatives of the other form.

One may attend the fairs of the country, and eight out of every ten of the Hambletonian stallions exhibited will present to the eye this unfortunate peculiarity. In reply it will be urged that these long-backed horses have an "enormous stride." We grant that they do stride a great distance, but we also notice that their feet stay under the sulky a long time. The power to "twitch their feet out from under the wagon," as an old driver once expressed it, does not belong to them. One never finds it in connection with a long back. We wish to breed colts with an "enormous stride" as earnestly as any one; but we wish that these colts blessed with an "enormous stride" should have the knack also of gathering quickly.

But, in respect to the length of the stride, we have this to say—that it is not in any way the result of the length of back, but the position of the pasterns, the slope of the shoulders, and the position of the great bones of the hindlegs. There must be length somewhere, of course, or else the horse cannot stride far; or, if he attempts it, will be forever "over-reaching," or "forging," as the phrase goes. But where should the length be located? That is the question to be answered; and we say, the length should be located below, and not above. The length should be put in between the shoulder joint and the hams of the horse. There is where it was put in Flora Temple, and which gave her so tremendous a stride for so small an animal; and there, too, is where you find it in Dexter, Fearnaught, and Taggart's Abdallah, whose stride on a sandy track we have measured and found to be twenty feet! If that is not an "enormous stride" enough to satisfy any one, we should be pleased to know what is; and yet Abdallah had a short, muscular, Morgan-like back, as his sire, Farmer's Beauty, and his grandsire, Gifford Morgan, had before him.

There never was a falser theory, or one calculated to beget more mischief among breeders, than this—that we must breed long-backed colts, in order to get length of stride. We have always noticed that the horses long in the back, and loosely coupled at the hips, are the horses that always come to the judges' stand padded and swathed with "pads," and "shields," and "protectors" enough to stock a small-sized horse-clothing establishment. The reason is, because there is too little strength in the back and loins to deliver their strokes in a straight line, or to "catch" quickly and handily when they "break." It is at such a time—the supreme hour of the animal's life, perhaps—when fame and money hang evenly in the balance, and ten thousand eyes are watching him, and the horse is going at the top of his speed, that formation and perfection of organic structure tell.—*Golden Rule.*

How to be a Successful Sawyer.

The following hints are given by Emerson, Smith, & Co., in the "Sawyer's Own Book":

1st. Acquire sufficient knowledge of machinery to keep a mill in good repair.

2d. See that the machinery and saws are kept in good order.

3d. It does not follow because one saw will work well that another will do the same on the same mandrel, or that even two saws will hang alike on the same mandrel. No two saws can be made that will run alike.

4th. It is not well to file all the teeth of circular saws from the same side of the saw, especially if each alternate tooth is bent for the set; but file one half the teeth from each side of the saw, and of the teeth that are bent from you, so as to leave them on a slight bevel and the outer corner a little the longest.

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5th. Never file any saw to too sharp or acute angles under the teeth, but on circular lines, as all saws are liable to crack from any sharp corners.

6th. Keep your saw round so that each tooth will do its proportional part of the work, or if a reciprocating saw, keep the cutting points jointed on a straight line.

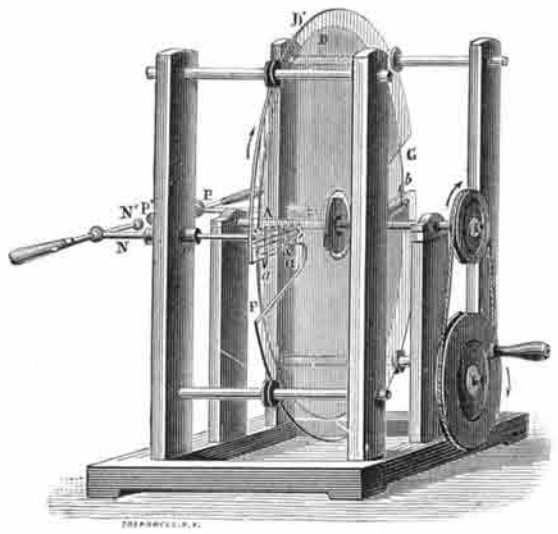
7th. The teeth of all saws wear narrowest at the extreme points; consequently, they must be kept spread so that they will be widest at the very points of the teeth, otherwise saws will not work successfully.

8th. Teeth of all saws should be kept as near a uniform shape and distance apart as possible, in order to keep a circular saw in balance and in condition for business.

NEW ELECTRICAL MACHINES.

In the accompanying illustrations, taken from a new work on static electricity, published in France by M. Mascart, are represented the latest forms of the Holtz, Carré, and Thomson electrical machines. The Holtz machine, Fig. 1, acts as a continuous electrophorus. It consists of a vertical plate, D, of thin glass varnished with gum-lac, which is

Fig. 1.

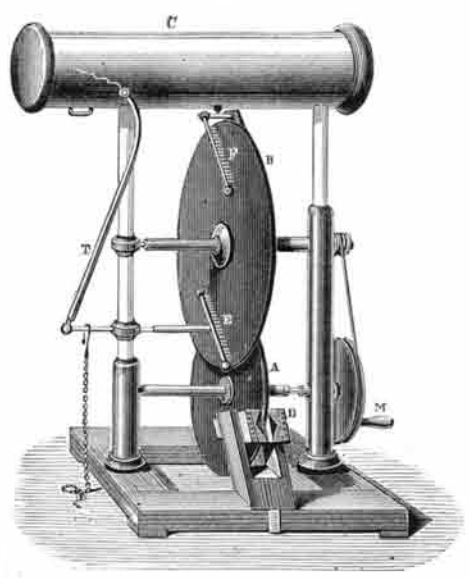


rotated at a speed of from 5 to 10 revolutions per minute. In face of this plate and at a short distance from it is a fixed plate, D′, slightly larger and pierced with a central opening, through which passes the axis of rotation. In this plate are made two rectangular apertures, F and G, at the extremities of the same diameter. On one of the sides of each one of these apertures is attached a layer of paper, A, applied on both sides and having one or two projecting portions, *a*, terminating in the openings, F and G. The two layers, A and B, serve as inducers, and are symmetrically disposed with reference to the axis of rotation. The first is represented in dotted lines in the engraving, in order to exhibit the portions in rear of it. On the other side of the movable plate are placed two insulated conductors, P and N, terminated by combs, which are directed toward the paper layers. These two conductors may be united by a kind of exciter with ebonite sleeves, the arms of which may be approached or withdrawn at will.

When the apparatus is operated, the conductors, P and N, are connected by bringing in contact the balls, P′ and N′. The movable disk is then turned in a direction contrary to that of the paper points, and one of the layers, *a*, is electrified. For the latter purpose a plate of ebonite, electrified by rubbing with the hand or with cat skin, may be used The fluid, supposed to be carried to *a*, persists as long as the machine is in operation, but disappears as soon as the latter stops, so that to begin again it is necessary to prime the instrument anew.

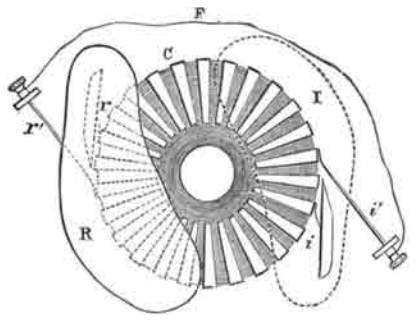
In the Carré machine, represented in Fig. 2, this difficulty

Fig. 2.



is sought to be avoided. The disk, A, of ebonite or glass passes between two leather cushions, D, and is carried directly on the axle of the crank, M. A pulley on the same shaft communicates, by means of a cord, rapid rotation to another and larger ebonite disk, B. In face of the latter are two combs, E and F; the second of which is opposed to a fixed leaf of ebonite furnished with paper layers, terminating in points and designed to serve as a second inducer, as in the Holtz machine. The upper comb communicates with

Fig. 3.



an insulated conductor, C, and the lower comb is also insulated, or communicates with the soil. An arm, T, serves as exciter.

The remainder of our illustrations relate to the Thomson machines. Figs. 3 and 4 represent what is known as the charge reproducer. A wheel, C, of ebonite carries a certain number of insulated metallic plates, disposed in sectors on the two faces, and appearing at the circumference like the teeth of a gear wheel. Two metallic plates, I and R, bent so as to envelop completely half of the wheel (one of these is indicated by dotted lines), serve both as inducer and receiver, that is to say, they act by induction on an intermediary conductor, F, and then receive by effect of the motion the electricity so developed. Hence it results that the charge of each of them augments at first in geometric progression, as in all analogous apparatus. Two receiving springs, *i* and *r*, communicating separately with the metallic envelopes in the interior of which they are placed, receive the electricity carried by the different sectors and communicate it to the corresponding envelopes. Two other springs, *i*′ and *r*′, called conductors, placed behind the former ones with reference to the direction of rotation of the wheel, are connected by the wire F.

Fig. 4.

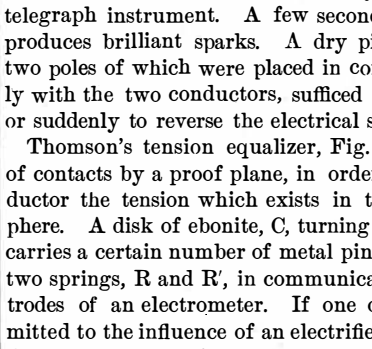
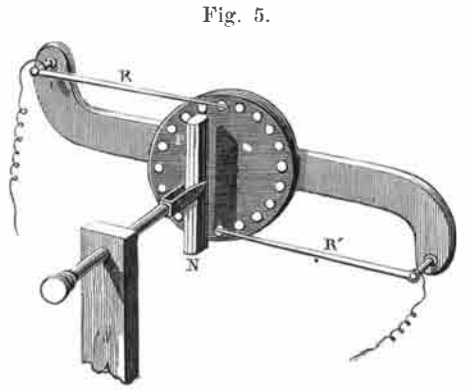


Fig. 5.



Supposing that one of the inducers, I, for example, be first charged with negative electricity. The corresponding spring, *i*, is then charged with positive electricity, which it communicates to the successive teeth of the wheel, which, by the receiving spring, *r*, transmit this electricity to the second inducer, R. The opposite spring, *r*′, is similarly charged with negative electricity, which comes back by the sectors and by the receiving spring, *r*′, to the first inducer, I.

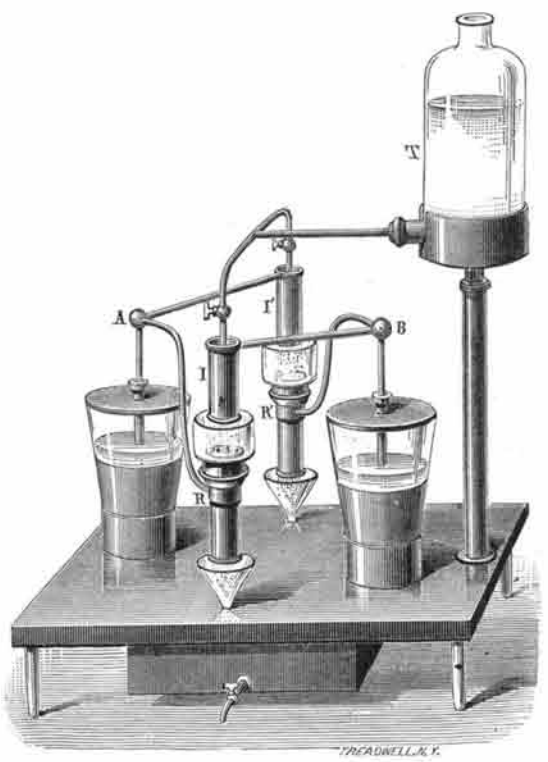
As constructed, the wheel is not more than 2 inches in diameter, and may be set in motion by the motor of a Morse telegraph instrument. A few seconds after it is started it produces brilliant sparks. A dry pile of 40 elements, the two poles of which were placed in communication separately with the two conductors, sufficed to charge the machine or suddenly to reverse the electrical signs.

Thomson's tension equalizer, Fig. 5, works like a series of contacts by a proof plane, in order to establish on a conductor the tension which exists in the surrounding atmosphere. A disk of ebonite, C, turning around a vertical axis, carries a certain number of metal pins, on which are applied two springs, R and R′, in communication with the two electrodes of an electrometer. If one of these springs is submitted to the influence of an electrified body, the keys which detach themselves from it in succession carry continuously electricity of contrary sign to that of the inducing body, until the electric density at the extremity of the spring becomes null. If the two springs are at the same time submitted to the influence of two conductors at different tensions, equilibrium will be attained at the end of a certain time, and quite rapidly, because the electricity carried off at one of the springs is taken to the other. The difference of tension of the two springs, or of the two electrodes of the electrometer, will be proportional to that of the two inducing bodies.

In Fig. 6 we represent another Thomson machine, in which T is a metallic tube, communicating with the soil. This is placed in the interior of a metal cylinder, I, which may be termed the inducer, having negative tension. This tube is electrified positively; and if liquid drops are allowed to escape therefrom, they carry with them contrary electricity, which is reproduced indefinitely. These drops fall into another metal cylinder, R, the receiver, which has a funnel within. The electricity of the drops expands over the surface of the receiver, and the drops escape in a neutral state from the spout of the funnel. The charge of the receiver then augments more and more until sparks are produced between the cylinders, or until the drops no longer fall into the receiver, on account of their being thrown off laterally by the electric repulsion which they encounter. Under such conditions it is necessary to maintain the tension of the inducer, I, by a foreign source. But it will easily be seen that two similar apparatus may be disposed so as to react one on the other, and to augment reciprocally their electric charges. For this purpose the receiver, R (Fig. 7), of the first, communicates with the inducer, I′, of the second, and the receiver, R′, of the second with the inducer, I, of the first. The drops which fall from the second inducer, I′, are then charged with negative electricity, which is collected in the receiver, R′, which augments the charge of the first inducer,

Fig. 6

Fig. 7.



I. Two conductors are united with the interior covering of two Leyden jars, A and B. These jars are covered exteriorly with tin, and contain a certain quantity of concentrated sulphuric acid. In the liquid are plunged lead rods terminating below with leaden plates. The rods are surrounded with glass tubes, and pass through an ebonite cover, so that the absolutely dry air contained in the bottles is not affected by the atmosphere. If the glass (Glasgow flint) is of good quality, the insulation of the bottles may be so perfect that the electric loss may not exceed one one-hundredth of the charge, in three or four days.

Under these conditions, one of the jars being electrified at a tension so weak as not to be appreciable but with a very delicate electrometer, the valves are opened in order to allow the water to escape drop by drop. These drops become subdivided into very small ones, which separate by their mutual repulsion. After a few minutes a rapid succession of sparks is produced in some part of the apparatus. It is stated that the loss of electricity in this apparatus is so small that a single drop falling from each tube every three minutes is sufficient to maintain the charge constant indefinitely.

New Method of Preserving Fish.

The flesh of fresh fish, either raw or boiled, is cut in thin slices and plunged in a bath of water strongly acidulated with citric acid. After two or three hours soaking, the fish is removed and dried, either in the air or under moderate heat. In the latter case one hour is sufficient; in the former there should be an exposure of five or six days. M. D'Amelie states that fish thus treated will keep anywhere for an indefinite period, and that it becomes as hard as wood. To prepare it for use three or four days' soaking in fresh water is necessary.

MR. RICHARD HANKS, a coal miner, living near Galesburg, Ill., is reported to have dug out of the earth, fifty feet below the surface, the entire carcass of a petrified mastodon, sixteen feet long and nine feet high, in almost perfect shape.

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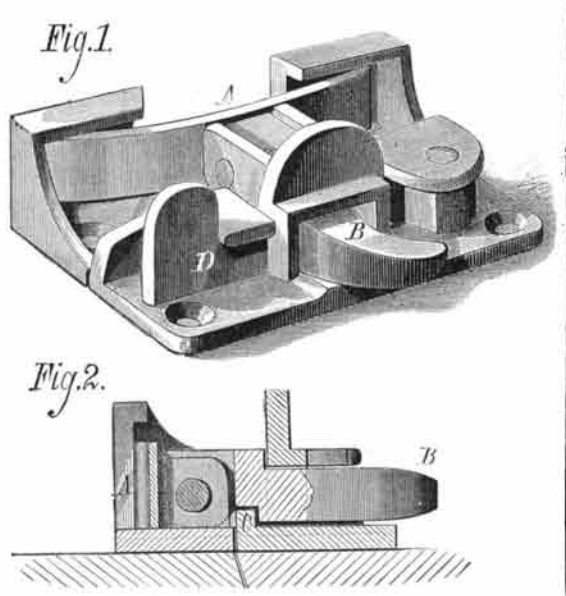
IMPROVED WINDOW FASTENER.

The annexed engraving represents a novel and simple device for fastening the sashes of windows at the meeting rails, so that said sashes cannot be raised or lowered by any one from the outside. The ordinary form of spring catch is after some use apt to work loose and to be freely movable, and it has often been opened by burglars introducing a thin steel blade between the rails and thus pushing it back. With the present invention this is impossible. The portion A, which is attached to the lower rail of the upper sash, has lugs in which is pivoted the tongue, B, which is acted upon by the leaf spring shown. This tongue may be turned up vertically, so as not to be in the way of raising or lowering either sash, and is retained in position by the action of the spring.

Pivoted in the portion of the device which is attached to



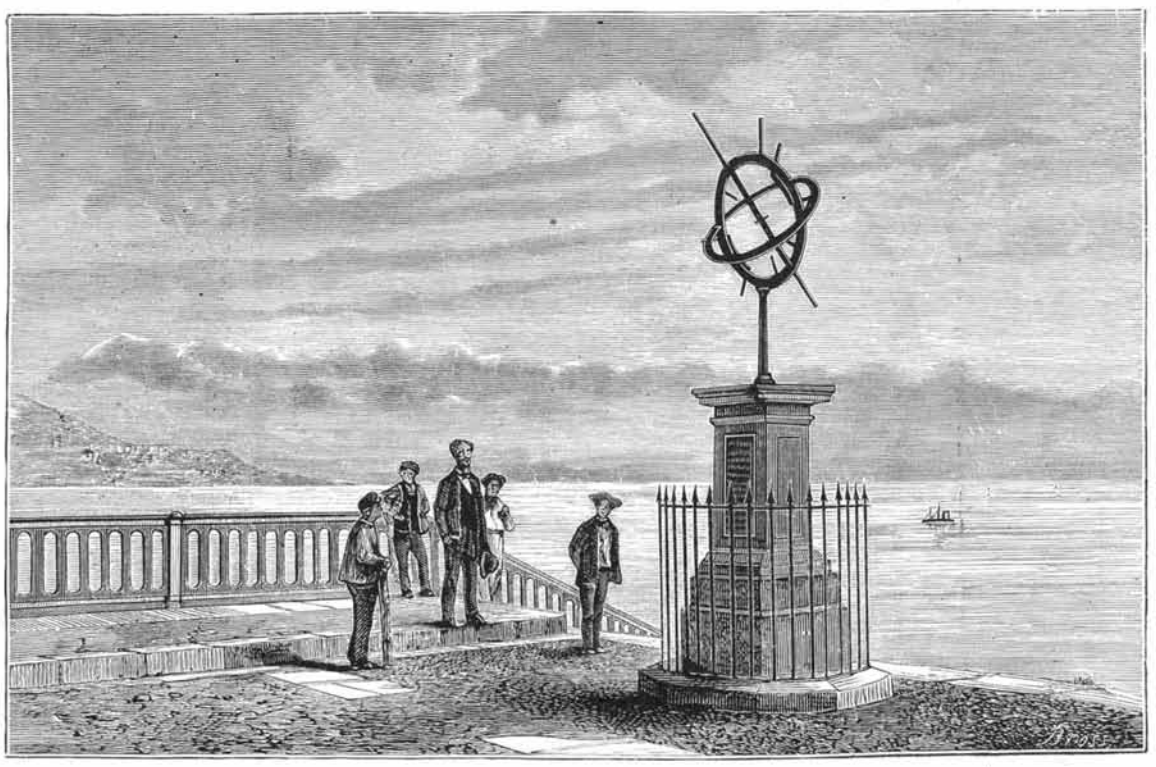
the upper rail of the lower sash is a spring clamp or catch, D. This has a recess which, when the tongue, B, is turned down, comes over said tongue, so that the same is thus prevented by the catch from rising or being moved sideways. A perspective view of the tongue thus secured is shown in Fig. 1 and a sectional view in Fig. 2. It will readily be seen that the device cannot possibly be tampered with by any one outside the window, as no tool can be introduced to reach and push back the catch, D. Patented September 4, 1877, through the Scientific American Patent Agency. For further particulars, address Clark & Smith, Chester, Orange county, N. Y.

THE COSMOGRAPH.

M. Riviere, of Marseilles, France, is to be credited with a capital idea for popularizing astronomical knowledge through the medium of a simple monument which may be set up in public squares, private grounds, or any other convenient locality. Several have already been erected in French cities, and our illustration, from *La Nature*, represents the one lately constructed at Nice.

The cosmograph, as the invention is called, shows, first, by a vertical circle, the plane of the meridian. A rod, directed toward the polar star, passes diametrically through the circle and shows the position of the earth's axis. A circle placed at right angles to the first indicates the plane of the equator. Of course the inclination of the axial rod varies according to the latitude of the locality. A small rod, placed vertically above the meridian circle, shows the zenith. Four other arms, fixed 23° above and below the equator, mark the tropics, and four more, placed at the same distance from the points of intersection of the axis, mark the polar circles. The graduation comprised between the tropics allows of the sun's movement in declination being followed, the solstices and equinoxes being observed, and the succession of seasons noted. The equator, divided into degrees and receiving the shadow of the axis, becomes a sun dial, an arc of 15° counting one hour. After a little practice it is easy to refer the curves of the cosmograph to the heavens, when the principal constellations may readily be found, especially those of the zodiac, through which passes the plane of the ecliptic or annual apparent path of the sun.

Inscriptions in relief show the names of the various portions of the instrument, and several useful astronomical facts and data are engraved on the pedestal.



THE COSMOGRAPH.

The Ventilation of Passenger Cars.

If the agitation of this subject during the past few years has not been productive of the best results that could have been desired, it has at least awakened public attention to the importance of car ventilation, and stimulated inventors in their efforts to devise more effective means for securing it. It is no very difficult matter to keep passenger cars tolerably well ventilated in summer, so far as the requisite supply of fresh air is concerned. An abundance of it can be introduced through open doors and windows, and by the ordinary roof ventilators—sufficient at least to disinfect or replace that which has been contaminated by breathing.

In winter, however, the conditions are very much changed. For at least seven months in the year, in this latitude, an artificial temperature, high enough for comfort, must be maintained, and this kind of comfort the great mass of railway travelers insist upon having. If good ventilation can be had along with it so much the better, but a chilly atmosphere and direct drafts from the outside must be avoided at all hazards. These tell at once upon the physical sensibilities, while the breathing of warm and impure air produces no immediate discomfort, nor does it excite any very great alarm with most people, even when headache, lassitude, and faintness supervene.

If the owners of a car can afford to line it with costly cabinet woods and showy trimmings, they can afford to furnish the occupants with the needed supply of pure air which surrounds it in a vast volume on every side and presses for admission.

Car builders in their discussions of this subject have attached, as it seems to us, an undue importance to a scientific analysis of the vitiated air in cars, as if there was any question about its deleterious qualities. Whether carbonic acid gas and the organic poisons, exhaled with the breath or discharged from the pores of the skin, go up or down, or are diffused through the car, or whether they will kill at ten paces or fifty paces, is not very material. They are in the car, and the essential thing is to get rid of them in a quiet, automatic sort of way, so that passengers will not know that it is being done. Under the conditions of winter ventilation, this can only be accomplished by a constant process of expulsion, and the introduction of a corresponding supply of warm and uncontaminated air. A car full of bad air will not go out unless an opportunity is afforded, and some of it will not go even then unless forced; and the necessary force or motive power must be derived from the speed of the train, or an inflowing current induced by rarefaction, or both combined.—*National Car Builder.*

Strength of Steel made without Blows.

At the recent meeting of the British Iron and Steel Institute, at Newcastle, England, a paper was read by M. Gautier relative to some remarkable experiments made with artillery produced from steel fabricated without blows, or, in other words, metal which had been simply cast, tempered, and reheated. A tube 8 inches in diameter was made with a hole 5 inches in diameter, so as to leave but 1½ inches of metal on the outside. Nothing was done besides tempering or reheating, after which the tube was grooved and a screw head adapted to carry the breech. Twenty shots were first fired with 9 lbs. of powder and a 40 lb. shell; then 10 shots with a shell weighing 47 lbs., and thereafter the charges of powder were successively increased by ¼ of a lb. every ten shots, the shell remaining identical until the 100th shot was fired. On examination, no fissure of any kind in the metal was discovered, and the deformation of the chamber was found to be less than half the average in forged steel tubes.

Previous to this test, several pieces of the metal were cut perpendicularly from the axis of the tube. The average results of four trials were as follows: Limit of elasticity in tons per square inch, 22·35: charge of rupture, 39·67; lengthening per cent, 12·47.

IMPROVED SAFETY ALARM AND DOOR BELL.

The annexed illustration represents a new safety alarm which may be used by travelers to attach to the door knobs of their rooms in hotels, so that no one can enter without the fact being indicated by the ringing of a bell. The bell is attached to a steel spring which is secured in one of the two slits, A or B, on the standard by means of suitable set screws. The foot at the lower end of the standard is cross filed so that it will not slip on the knob when attached as shown in the engraving. To secure the device in place, a

rubber strap passes around the shank of the door knob and buttons on a screw on the standard. The knob consequently cannot be turned from the outside without the bell being caused to ring. The arrangement may also be modified so as to form an efficient permanent door bell. In this case a rod passes through the door casing and is rotated by a crank handle outside. The inner end enters a square hole in the standard where it is secured in a set screw. On a suitable guard plate are provided arms which extend on each side of the vertical standard and prevent its being turned down too far. The bell is adjusted, in accordance with this arrangement in the lower slit, B.

Housekeepers and business men generally will find the alarm device a useful means of protection, as burglars seldom venture in a room when the bell rings. If arranged on the chair round, the chair may be placed at an open window, and an attempt to move it will ring the bell. Farmers can attach it to outhouses, and if they wish, extend a cord or wire from the outhouse to the bed room, so that an attempt to enter will notify them, and the burglar, not hearing it ring, can be surprised and captured.

Patent pending through the Scientific American Patent Agency. For further particulars, address W. N. Patterson, Frankfort, Ky.

Spectrum of Candle and Gas Lights.

With the aid of the spectral photometer MM. Vogel and Müller have examined the most common sources of light with regard to their intensity in different parts of the spectrum, and have reached the following, among other results: The light of a wax candle is in the blue weaker than that of the stearin and paraffin candle. Petroleum shows in blue greater intensity than oil. A petroleum lamp with the wick newly cut emits more blue and violet rays than when it has burnt some time. A gas flame is in red and blue and violet brighter than a petroleum flame. The individual parts of flames which show a considerable difference as to total intensity differ but little with regard to different parts of the spectrum. A petroleum lamp emits more refrangible rays than a Silber oil lamp, but the reverse is the case with a Silber lamp burnt with petroleum, as compared with the same ordinary petroleum lamp. A comparison of a petroleum lamp with a Drummond limelight led to the result that the Drummond lime light has a considerably greater intensity in the spectrum from green downwards, this being even doubled in the blue and violet colors.

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1. Platanthera bifolia. 2. Ophrys apifera. 3. Cypripedium calceolus. 4. Orchis Morio. 5. Oncidium lentiginosum. 6. Burlingtonia decora. 7. Vanda tricolor. 8. Phalænopsis amabilis. 9. Cattleya maxima
10. Restrepia elegans. 11. Odontoglossum grande. 12. Dendrobium chrysanthum. 13. Coryanthes Albertinæ. 14. Stanhopea ornatissima. 15. Cymbidium aloëfolium.

GROUP OF ORCHIDS INDIGENOUS AND EXOTIC.—[See next page.]

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A Curious Experiment.

We have now at Central University a singularly beautiful experiment in operation, showing the motion of the earth. It has been contrived and successfully completed by Professor T. W. Tobin, who has charge of the department of chemistry and physics in the University. The apparatus may be briefly described as follows: Upon an iron stand, about six feet in height, an exceedingly delicate pendulum is suspended; attached to the upper portion is some mechanism and a fine index needle. The apparatus was brought to a state of perfect repose, and then the pendulum, by means of a fine silk, vibrated north and south. In the course of six minutes the index showed that the normal relation between the pendulum and the earth had altered, and a longer interval indicated an increased variation. In 1851 Foucault, a French scientist, reasoned that while all bodies are governed by gravity, independent motion is not: that in virtue of inertia, a body moved will continue in motion forever; so a pendulum once started in vibration will continue to oscillate in the same direction until gravity and the friction of the air bring it to a state of rest.

The earth's revolution being a circle, there must be a variable relation between the two motions, namely, the circle and the straight line of the pendulum's direction. The apparatus now described shows this relation. An experiment was made by Foucault in Paris with a pendulum over 200 feet long; a similar experiment at Bunker Hill and then at Yale College prove the principle: but the apparatus employed was costly and cumbersome. The instrument at Central University is simple and delicate, and is calculated to create interest in scientific circles.—*Kentucky Register, Richmond, Ky.*

Hot Water for Tire Shrinking of Wheels.

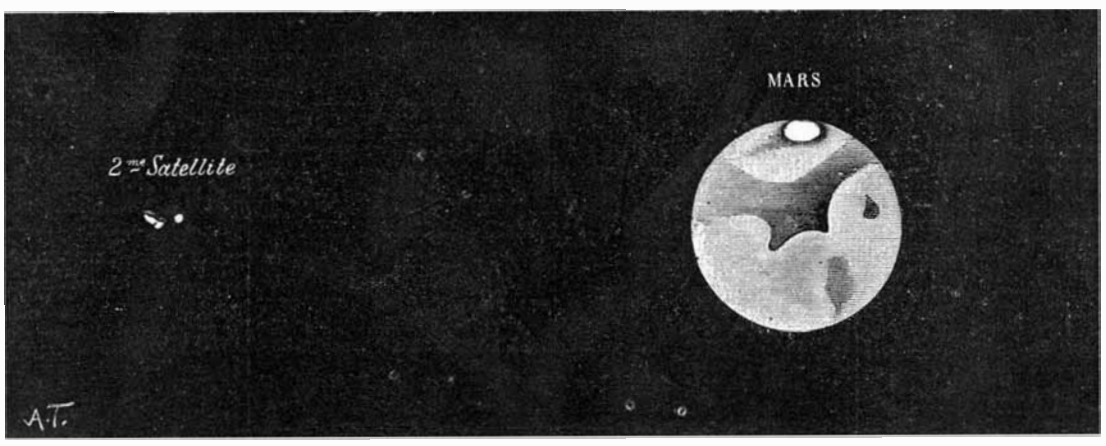
The expansion of tires by hot water, though not claimed to be new, is believed by the author to be much superior to the ordinary method of using fire. As applied on the Moscow-Nijni Railway, an iron tank, one fourth filled with water, is fixed near a stationary boiler, a steam pipe from which is led through it, capable of heating the water to 212° Fah. Into this the tire is plunged by means of a portable crane, and after an immersion from ten to fifteen minutes, is taken out and immediately placed on the wheel. Three men only are employed, who will fix from twelve to fourteen tires in a day of eleven hours. The allowance for shrinking (the difference between the diameter of the skeleton and that of the tire) is 0·75 millimeter to a meter. This is ascertained by gauges of great accuracy, and, if deviated from, the tire will be either loose after cooling or too small to get on the wheel. When fire is used, the tire can never be heated equally or cooled equally in all parts, and in consequence is sure to be more or less oval in form, which is not the case in hot water. The above railway made a comparison between the two, the results of which are given. It appears that, during a six years' trial of fire-shrunken tires, 37 per cent ran loose and 5 per cent were broken; while during a three years' trial of water-shrunken tires less than 1 per cent ran loose, and only a single tire was broken. The liability to breakage in the former (produced by the irregularity in form) is much insisted on by the author as being, of course, more dangerous and costly than the loosening of the tire.

THE SATELLITES OF MARS.

We take from *La Nature* the annexed engraving of the planet Mars and its second satellite, as the same appeared through the great telescope at the observatory of Paris, at 10:15 P.M., on August 27 last. The first satellite moves around the planet in 15 hours, at an average distance of 9,000 miles; the second completes its course in thirty hours, and is distant about 15,000 miles. Both bodies are very small, and their observation requires powerful instruments. Judging, however, by its brilliancy, the diameter of the second satellite is estimated at only some 30 miles.

Future observation of their motion will lead to the exact determination of the elements of their orbit, and will show whether the revolution is relatively direct, as in the case of the moons of Jupiter and Saturn, or relatively inverse, as in the case of the satellites of Uranus and Neptune. It will also lead to more exact data relative to the mass of Mars.

In a former article on the discovery of these bodies, we noted the fact that while most astronomers did not regard it even as probable that Mars might have satellites, others had admitted the possibility, and had predicated their admission on certain physical characteristics of the planet itself. *Les Mondes* has recently published an extract from a work by Béron, a French astronomer, entitled "Celestial Physics," and printed in 1867, wherein the author says: "Mars is distinguished from the seven other planets by its satellite, which no one has ever seen, although it exists, because Mars has thrown out jets of burning matter, to which are due, first, its rotary movement, and, second, the existence of two recesses which appear to be movable spots. It appears, incontestably, that these spots are due to light reflected in different degrees by the slopes of these recesses, which are constantly being differently exposed to the sun and to the earth."



MARS AND ITS SATELLITES.

ORCHIDS.

The orchids constitute a beautiful family plant, so called from *orchis*, their ancient name. Popularly any one of the family, of whatever genus, is called an orchis. Their number is legion, and includes a veritable host of smaller flowering kinds, whose blossoms yield in nothing but size to their larger compeers; and their beauty and conformation, when looked for, is often more extraordinary and interesting.

The large illustration on the preceding page gives a comparative idea of some of the orchids, collected from different countries. For instance, the *Restripui*, Fig. 10; the *Burlingtonia*, Fig. 6; the brown and golden twisted *oncidians lentiginosum*, Fig. 5; and the brilliant *odontogossons*, Fig. 11; are inhabitants of North America. The strangely tinted, blue, white, and brown *banda tricolor*, Fig. 7; the white *pholænopsis*, Fig. 8; the orange and brown *dendrobium chrysanthum*, Fig. 12; belong to Asia. South America gives the beautiful *cattleya maxima*, Fig. 9, with its varying colored lips; the curiously formed purple *coryanthes*, Fig 13; and the large *stanhopea ornatissima*, Fig. 14; with its

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

sweet scented yellow and brown dotted blossoms. The Chinese *cymbidium aloefolium*, Fig. 15, with its yellowish brown blossoms forms, the link between the orchids of the tropics and the temperate zone.

In the lower group is given the modest flowers which are the parents of their larger and more grotesquely developed descendants. In this group are represented the lady's slipper (*cypripedium calceolus*) Fig. 3, and the shoe-shaped *orphrys apifera*, with a bee-like lip; the sweet scented meadow hyacinth, *platonthera bifolia*, Fig. 1; and the common *orchis morio*, Fig. 4, from which the class receives its name.

The distinguishing feature of the orchids is the column and it is embodied in them all, be they large or small. Figs. 1 and 2 give an enlarged representation of this column, Fig. 1 being a front view, and Fig. 2 a side view, of the same of the indigenous orchid (*latifolia*) while Figs. 3 and 4 give the same views of the exotic flower.

Orchids are among the most valued of cultivated flowers, some for their beauty, others for their fragrance, while others are admired for their grotesque forms. The forms are sometimes wonderfully simulative. The flowers of one species resembling the mouth of a cuttle fish, others resemble a large spider, while in other species the flowers bear a great resemblance to various insects, for instance the butterfly orchid (*oncidium papillo*) which in form, size, and color resembles somewhat a gaudy butterfly.

The cultivation of orchids is a passion with many horticulturists, who spare neither time nor expense in their favorite pursuit.

A New Military Arm.—The Torpedo Hunters.

A correspondent of a German journal, writing from Erzeroum, gives the following account of the new corps of divers which has been organized by the Turkish government for the purpose of removing the torpedoes laid down by the Russians in the Danube and on the shores of the Black Sea:

The divers are Mohammedans from Lazistan, and a certain number of them are attached to each of the Turkish squadrons cruising in the Black Sea. When the ships arrive near a spot where the existence of torpedoes is suspected two of the divers row to the place in a very light boat, drawing so little water that there is scarcely any danger of its striking against the torpedoes. On arriving at their destination one of the rowers dives into the sea; if he finds a wire or rope by which the torpedo is attached he cuts it with a sharp instrument and returns quickly into the boat. The liberated torpedo floats to the surface of the water, the men pass a short lasso around it, take it in tow, and then row back to the ship as quickly as possible. For each torpedo thus captured the divers are paid $45, and also a sum of money equal to one half of its value. Although the men have been often employed on this dangerous service, not a single accident has occurred to any of them.

Effects of Timber Waste.

Colonel Playfair, British Consul General for Algiers, has sent to his government a report which offers some striking instances of the injury done to a country by the reckless destruction of forests. He states that the principal cause of the decadence of the entire region of Tunis and Algiers and the exhaustion of the soil is directly owing to tree felling. Meteorological observations have been carried on in Algiers since 1838. During the first twelve years of the intervening period the rainfall averaged 32 inches annually, during the second twelve years it had decreased to 30·8 inches, and during the last fourteen years it has been but 25·5 inches. The decrease became apparent after the first serious clearings of wood in 1845, and during 1876 so exhausted had become the soil that a famine seemed imminent in Western Algeria.

Magnetization of Sheffield Steel Bars.

M. Gaugain, who for some time has been conducting investigations with the influence of heat on magnetization, has recently announced some very curious results obtained with Sheffield steel bars. He found that, when certain bars were magnetized at a high temperature and cooled, their magnetism entirely disappeared, and then changed sign; so that if a bar had been magnetized when hot in a certain direction, it was found to be magnetized in the opposite direction after returning to the ordinary temperature. When heated afresh, the inverse magnetism, which is always very feeble, vanished, and the primitive magnetism reappeared. The same change of sign is reproduced when the bar is again cooled.

Experiments with the Dynagraph.

The Springfield (Mass.) *Republican* of recent date says: A very interesting series of experiments have been in progress on the Boston and Albany road the past few days by means of the dynagraph car of the Eastern Railway Association, in charge of P. H. Dudley, which has been run between Springfield and Worcester on both freight and passenger trains, to test the relative amount of power required at different points along the road, especial reference being had to the Springfield and Charlton grades. The experiment on the Modoc train, leaving Springfield at 6.30 A.M., which, on the day in question, consisted of two sleepers, four passenger and baggage cars, and the dynagraph car, showed power required as follows: For the first 2,920 feet out of the depot the tension on the draw-bar was 6,526 lbs.: for the next mile 6,469 lbs., the rate of speed being 32 miles per hour; for the next, 6,200 lbs., the speed being 36 miles and for the last 1,100 feet, to the top of the grade, 6,250 lbs. The last mile required the engine to produce 19,625,800 foot pounds of power per minute.

In going up the grade from East Brookfield to Charlton, beginning at the station, the tension on the draw-bar for the first 3,880 feet was 5,722 lbs.; for the first full mile, the velocity being 37·5 miles, 4,280 lbs.; for the second mile, with 37 miles velocity, 5,232 lbs.; third, with 36 miles velocity, 5,450 lbs.; fourth, which contains a sharp curve, with 37 miles velocity, 5,612 lbs.; fifth, with 41 miles velocity, 5,230 lbs.; and sixth, which ran a little past the summit at Charlton, 4,356 lbs.

The engine had an 18 inch by 24 inch cylinder, and the track was in excellent condition. The maximum of the

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Springfield grade is 60 feet to the mile, and the Charlton grade 51·47 feet. At the sharpest curve the grade is about 49 feet. Similar experiments were made on a freight train of 27 cars, drawn by the Adirondack, famous for her trials with the Mogul engine last summer, and showed that the tension on the draw-bar going up Springfield grade at a speed of 5·9 miles per hour, was about 16,000 lbs.; and the average strain going up Charlton grade at an average speed of about nine miles per hour, was 14,500 lbs.; the power required in the first instance being 84,840,000 foot pounds. Near the top of the grade the power of the engine was tested by applying the brakes, and it was found that, running at four miles per hour, the engine could exert a tension of 17,000 lbs. Beyond this point the drivers would slip and little progress was made.

Really, the most important experiments in which the association is just now engaged are in testing the quality of iron and steel used for bridges, rails, axles, and car wheels. Recent trials of the tenacity of iron used for various bridges and car axles indicate that much of the iron now in use will only stand about two thirds the strain which it is guaranteed to resist. For instance, some iron now being put into a new bridge at the East, which is supposed to stand a pressure of 60,000 lbs. to the square inch, breaks readily at 40,000 lbs., and a car axle, supposed to be equal to 110,000 lbs., snapped at 70,000lbs.

When it is borne in mind that the calculations of bridge building engineers are based on the guaranteed strength of the iron, the reason for the fall of iron bridges becomes apparent at once, and instead of wondering at an Ashtabula horror, the wonder rather is that it is not repeated. The Eastern Railroad Association, which is making these experiments, represents all the railroads on the Atlantic coast north of Richmond, Va., and east of Pittsburgh and the Alleghenies, and was organized about ten years ago, having for its object the investigation of the validity of patents and claims to royalties for the use of the same. S. M. Whipple, of South Adams, is the general agent. The scope of the association has naturally broadened, and it has been for the past few years largely engaged in testing the merits of various railway equipments with the idea of getting the best in every department. The dynagraph car is a curiosity in itself, containing, besides the dynagraph, which is an ingenious instrument, registering exactly the amount of power required to pull a train, a chronograph, which records the speed of the train every 7½ seconds; an anemometer, which registers the velocity of the wind, whether natural or caused by the motion of the cars; and a complete set of instruments for testing the hardness, tenacity, ductility, density, and the amount of carbon in rails, axles, etc.

The Use of Glue and its Applications in Carriage Body Making.

The following suggestions are from the pen of Mr. John D. Gribbon, the veteran carriage body maker of this city: Glue is obtained by boiling the skins and hoofs, etc., of animals, also the skins and some other parts of fishes: but that from animals is considered the best, and that obtained from the skins of old animals is considered better for the purpose than that from young ones. The strongest glue of all—Russian isinglass—is made from the air bladders of a species of large fish found in the Russian seas, but its great price excludes it from use by the carriage trade, when other glues can be substituted. From experiment made it has been found that glue made from the sinews and skins of animals is superior to that made from their horny parts; but the latter, again, is found from actual observation in practice to be much superior to glue made from the skins, etc., of fishes, as it is not so subject, as the last named, to be affected by the atmosphere. Animal glue is, for the reason just named, unquestionably preferable to fish glue, although the latter is sometimes sold as first quality glue.

TESTING GLUE.—In the selection of glue, the testing of it, so as to form some estimate of its adhesive qualities, is a matter of first importance. All glue in the cake is subject to be influenced by the moistness or dryness of the atmosphere, becoming soft in damp weather and crisp in dry weather, but different kinds are differently affected, and hence it is better to purchase in dry weather, as that which is *then soft is not of as good quality* as that which is crisp; and it should be borne in mind also, when purchasing, that the *most transparent* is generally the best. It is always advisable, before purchasing, to submit to experiment a sample of the article offered. To do this, take a cake of glue, place it in a pan, and cover it with water; when, after some hours, if it be good glue, it will *swell but not dissolve*, while, if bad, it *will partly if not wholly dissolve in the water*. Another test is this: After being dissolved by means of heat, that glue is best which seems most cohesive, or which is capable of being drawn out into thin filaments or strings, and does not drop from the brush or glue stick as water or oil would, but rather extends itself in threads, as it falls from the brush or stick; and if the glue possesses the requisite properties, this will always be found to be the case.

PREPARING GLUE.—The preparation of glue is very simple. It is first broken up in small particles and put into a vessel, covered with cold water, and left to soak for a number of hours, the length of time required for soaking being generally governed by the strength of the glue, the strongest glue taking the longest time. After being soaked until it all swells and becomes soft and gelatinous (avoid oversoaking) it is then placed upon the fire to cook, being kept rtirred until it is thoroughly dissolved and appears stringy, as we stated above. It is then ready for use; but in factories where a large quantity is employed, it is then poured out in a large flat pan and left to cool; and the workman, when desiring it for use, cuts off the required quantity and heats it. I would remark here that it is a bad habit for workmen to allow the glue pot to remain on the stove after they are done using it, as a very prolonged heat will destroy the adhesive qualities of the glue.

In some of the large carriage factories of the United States, where steam is generally used, a steam jacket is provided to receive the glue when it requires to be warmed, and, in connection with this jacket, a pipe heated by steam is generally added, on which panels may be warped bent, which proves a very expeditious and convenient process for both the purposes named, and preferable in every way to the use of a stove.

As a novelty in the way of preparing glue, the pulverized article, which has recently been introduced to the trade, merits mention here. In passing along one of our thoroughfares my attention was attracted, not long ago, by a sign on which the words *pulverized glue* were prominently displayed, and being curious to see the article and learn its advantages, I went in and asked an explanation from the proprietor. It seems that the pulverized glue is recommended for its convenience, being more quickly prepared for use than that which is in cakes, the latter requiring several hours to soak, whereas the pulverized can be soaked just as thoroughly in a few minutes; and this is a great advantage, particularly in warm weather, when glue put to soak is often liable to spoil. Again, if a workman's cooked glue runs out, he can in a short time prepare more from the pulverized, and this is often a great convenience, as every workman knows, especially when quitting time is near at hand.

We would say further in regard to glue in the pulverized form that it avoids the serious injury by salt air that affects glue in the cake in crossing the ocean, and it is for this reason particularly adapted for exportation.

APPLICATION OF GLUE.—Referring to the letter of your London correspondent, it is worthy of note that, with very few exceptions, no stoves or heaters are used in the English body shops, and, when a panel is to be bent or the glue to be heated, recourse must be made to the smith-shop to accomplish the object, but good gluing cannot be done under these circumstances, and particularly in a climate like the English, that is almost continually moist. In the United States, on the contrary, every carriage maker, even if he is doing business on the smallest scale, will have a stove for heating his body-shop in cold or damp weather, and also for bending his panels, shavings and waste stuff usually constituting the fuel employed. The heat of the body room is generally kept at a temperature of from 55° to 65° Fah., which is a comfortable one for the workmen to labor in, without becoming exhausted from the heat, and such a temperature will render the workman more cheerful, and cause him to accomplish more work than is the case (particularly common in England) of cold winter weather with an unheated shop, when the workman feels as if he touched ice when he takes hold of his tools, which feeling certainly does not expedite his labors, and when he feels glad at the approach of quitting time, that he can warm up at the tap, and take a drink of something warm.

There is no reason why in England bodies could not be glued together as well as here, provided the room were properly warmed and proper precaution taken. Some may raise the objection that glue will not hold so well on the hard ash here employed, but some years ago I saw bodies glued here in Mr. Charles Parker's factory, very hard ash and mahogany being used, and they held together quite as long and as well as any others having whitewood panels. The only difference in the case of using very hard wood is that the surfaces to be glued together should first be roughed with a tooth plane, or other tool, as a file or saw.

The following additional suggestions may be of value in applying the glue:

In all American carriage factories the side, back, and front panels are glued on, no nails being used, excepting one small tack in each corner to keep the panel in place while the straps and hand screws are being put on. In putting on the neck and bottom arch panels, some builders use both nails and glue, while others use glue without any nails, mitering these panels along the edges without nails, and where properly fitted and put on, no trouble is experienced from their giving way.

In the case of panels glued on, there is of course no fear of nails showing, while the latter is frequently the case on English carriages, even when the top quarters and back have been covered with leather, the nails showing through all. French carriage builders, until quite recently, have always nailed on the neck panels of boots, but the nails would always, in spite of the greatest care, show through the paint and varnish, and latterly they have been covering the necks of their boots with enameled leather, to avoid this trouble. It was the knowledge of this weakness in French carriages, in connection with the perception of its absence in American carriages, that, at the time of our Centennial Exhibition, first led some of their celebrated builders to look into the advantages of using glue to hold the panels on without nails.

When panels are glued on—properly on—there is no occasion to cover the quarters with leather. In the matter of roofs, some American builders cover them with patent leather, neatly nailed in a rabbet in the side-top and end rails, while others prefer to cover them with duck and paint in the same manner as the panels. Still others put on the roof board in one piece (which is easily obtained since the new method has been introduced of cutting panels from around the log, whereby the width is limited only by the diameter of the tree), and closely block the same on the inside, no covering of cloth, leather, or other material being required, as was the case with the old method of putting the roofs on in narrow boards.

We will add two further suggestions in this connection, namely, in applying glue, where the part is end grain, first fill the pores of the wood with thin glue, and let dry; then clean off, and glue at the joint with strong glue. Many a job has been spoiled by reason of neglecting to fill the end grain in this manner. Next, in adding water to glue, it is best to give the glue a boil before using again, so that it may be evenly and thoroughly mixed.—*The Hub.*

NEW BOOKS AND PUBLICATIONS.

SANITARY ENGINEERING. By Baldwin Latham C.E. Published by George H. Frost, Chicago. Price $3.00.

This is a reproduction of the English work published by Mr. Latham in 1873 It is a series of excellent and valuable papers forming a guide to the construction of works of sewerage and house drainage. It has heretofore been printed as a supplement to the Chicago *Engineering News*, from the stereotype plates of which the present book is made. Illustrations are abundant and good, and the work is sold at one quarter the price of the original English edition.

THE ELEMENTS OF DESCRIPTIVE GEOMETRY. By S. Edward Warren, C.E. John Wiley & Sons, 15 Astor Place, New York city. Price 3.50.

This is a new work prepared we are informed to meet an evident demand for brief text books. The author explains clearly, arranges his topics logically and uses the fewest words possible, all excellent features, and in brief has compressed into comparatively small space as compared with other works on the subject, a very full view of the science. The plates accompanying the text are bound in a separate and handy volume, and thus rendered easier for reference.

BREAD AND CAKE BAKING. By Frederick D. Hauptmann. Price $1.00. Published by the Author. P. O. Box 94, New Waterford, Ohio.

A collection of recipes, differing from those ordinarily found in cook books in that they are the work of a practical baker of experience and are especially intended for the trade.

PERFUMERY AND KINDRED ARTS. By R. S. Christiani. Price $5.00. Henry Carey Baird, Publisher. 810 Walnut street, Philadelphia.

The climate of the United States, is so diversified says the author, and in many parts so well adapted to the cultivation of numerous plants which are useful to the perfumer, that the author hopes by this treatise to awaken attention to the practicability of establishing flower farms and orange groves, as well as to the utilization of many indigenous plants now neglected for perfumery purposes. The work he offers is a complete encyclopedia apparently covering all branches of the subject. Descriptions are given of all the materials used in perfumery, of the laboratory and its requirements, and then follow a very large number of recipes for extracts and bouquets, aromatic and toilet powders, hair oils, pomades, hair dyes, essences, soaps, etc. In an appendix are instructions for making sugars, jellies, candies, cordials, etc. All the recipes have been carefully revised and many are the result of the author's long experience. The work will doubtless prove exceedingly valuable to the perfumer.

HOW TO DRAW A STRAIGHT LINE. By A. B. Kempe, B.A. Macmillan & Co., 22 Bond street: New York. Price 50 cents.

This is a continuation of the set of technical volumes, known as the Nature Series. It is a lecture on linkages, fully treating the subject and copiously illustrated.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED COMBINED SPRING SHACKLE AND STEP.

Reuben Doty, Wellsville, N. Y.—This invention consists in the peculiar construction of a shackle for coupling the springs of platform wagons, and in the combination of a step with the shackle. Portions of the shackle are secured to the ends of the wagon springs by bolts. These parts are similar, and consist of a round bar, from the ends of which the arms project at right angles and parallel to each other. At the ends of these arms eyes are formed for receiving bolts. The bars of the other parts are arranged at right angles to each other, and between them a bearing piece is placed, which covers half of the surface of each of the bars. From upper part of bearing piece an arm projects, to which a step is secured by means of a rivet or screw. The advantages claimed for this improvement are that the shackle is cheaply and easily constructed and applied. Friction is distributed over a large surface, so that the wear is reduced to a minimum, and the step is always kept in a horizontal position.

IMPROVED GAS DROP-LIGHT.

William B. S. Taylor, Westfield Township, N. J.—The nature of this invention is such an arrangement and application of flexible tubing to such drop-lights or chandeliers as will protect the tubing from injury by unnecessary coiling or rubbing and the heat of the lights when the chandelier or drop-light is in use, and will carry it out of the way when it is not in use. In this improved method of constructing chandeliers and drop-lights the tubing is to be attached to the lower parts both of the suspending and of the stationary parts of the fixture, and is allowed to hang or is estooned in a manner agreeable to its nature.

IMPROVED FEED BAG.

Thomas R. Lowerre, Mott Haven (Morrisania Station), N. Y., assignor to himself and Richard U. Wright, of same place.—The object of this invention is to furnish an improved feed bag for horses, which shall be so constructed as to allow the oats to pass down to the horse's mouth as fast as he eats them, and no faster, which will allow the horse to have plenty of air while eating, which shall be evenly balanced, so that the horse can eat comfortably, and which will prevent the oats from being thrown out by the horse. The body of the feed bag is divided by two partitions into three compartments—a central compartment, into which the horse's nose is inserted, and two side compartments, in which the grain is placed. The lower edges of the partitions extend nearly to the bottom of the bag, space being left beneath said edges for the grain to pass slowly into the bottom of the central compartment as fast as the horse eats it.

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IMPROVED ATTACHMENT FOR CARPENTERS' SQUARES.

Jeremiah Daniels, Sharon, Wis.—This invention relates to an improved attachment for carpenters' squares, and it consists of a number of parallel bars that are secured to slotted end pieces that are clamped to the square by means of screws and nuts. The object of the invention is to provide a square that will facilitate laying out single and double mortises, tenons, and other operations in carpentry. The square is used by placing its longer arm against or upon the timber to be laid out and marking at the sides of the parallel bars for the sides of the mortises or tenons. The attachment does not interfere with the use of the square in the ordinary way, as the heads and nuts of the bolts are on a line with the inner edge of the square beam and serve to guide it. If the bars do not stand in the required relation to the side of the timber, the slots in the end pieces and the colts afford a means of adjustment.

IMPROVED LINE FENDER FOR HARNESS.

Thomas J. Lindsay, Windfall, Ind.—The object of this invention is to prevent a horse, in double or single harness, from getting the lines under his tail, and the nature of the invention consists in a fender or shield which is made of wire or leather, and shaped to fit the upper portion of the tail of a horse, said fender or shield being provided with a tail strap, side pieces, and other means for properly fastening it to the harness.

IMPROVED BRACELET.

Julius Hackenberg, New York city, assignor to himself and Charles H Graef, Edgewater, N. Y.—This bracelet is formed of a number of parallel rings, held together by cross stays, which are grooved exteriorily, so that the rings project above them, whereby, at a short distance off, the stays are not at all or scarcely noticeable, thus giving to the bracelet the appearance of a series of independent rings, while at the same time the rings are firmly united together.

IMPROVED MUSTACHE SPOON.

Roger Williams, Yonkers, N. Y., assignor to himself and Robert J. Anderson, New York city.—This invention relates to an improved spoon to be used by persons with mustaches, the spoon keeping off any part of the soup or other fluid from the moustache, while admitting the easy taking of the liquid, and also the convenient cutting of any larger part therein; and the invention consists of a spoon whose bowl is placed at a suitable angle to the handle, provided with a lateral mustache guard, extending at slight inclination across the front part of the bowl, and arranged with a cutting edge at the rear portion. The position of the bowl to the handle facilitates the taking up of the liquid over the rear part of the bowl and the ready conveying of the same into the mouth by a turn given to the handle, which tilts the bowl and empties the same of the liquid.

IMPROVED BELL PIANO.

William H. Wood, Port Rowan, Ontario, Canada.—The object of this invention is to provide a musical instrument in which bells are employed to produce the musical sounds. It consists in the arrangement, in a casing similar to that of an ordinary piano, of a number of bells of either metal, glass, or pottery, properly tuned, and in an arrangement of hammers operated by means of keys, and in dampers and softeners operated by pedals or stops. The softeners consist of pieces of leather, which are attached to bars that are moved by an arrangement of levers similar to those of an ordinary piano.

IMPROVED SELF-ADJUSTING EYE SHADE.

Thomas A. Platt, Brooklyn, N. Y.—The object of this invention is to furnish an improved eye shade, which shall be so constructed that it will adjust itself to the shape and size of the head, and may be worn without causing pain or annoyance to the wearer. The invention consists in an improved eye shade formed by the combination of the two springs with each other and with the shade. To the ends of the spring are secured, by rivets or other suitable means, the ends of a similar metal spring, to pass over the head of the wearer, and thus keep the shade in place.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FRUIT JAR.

Hiram Purdy, Burlington, Iowa.—The object of this invention is to furnish fruit jars which shall be so constructed that they may be closed perfectly airtight, and which will allow their covers to be easily removed. The cover, which fits into the mouth of the jar, is tapered, and has a wide shallow groove formed around it to receive the rubber band or packing. The jar is closed by pressing the cover down into place while the contents of the said jar are hot, and have thus expelled the air. To open the jar the upper edge of the band is drawn down to uncover the air hole and allow air to enter the jar. The cover is then drawn to one side, which forces the edge into the groove and allows the other side of the cover to be raised.

IMPROVED BED BOTTOM.

Germain Luciani, Paris, France.—This invention relates to an improved elastic mattress, which is constructed chiefly of wood, and is designed to supply a cheap and useful article, having advantages which have hitherto only been obtainable at high prices. All elastic mattresses hitherto constructed, even those having lengths or laths of wood, have been provided with springs, and this invention is designed to avoid this costly and complicated arrangement, being based essentially upon the principle of utilizing the inherent elasticity of the strips of wood or laths, united by bands or straps fastened rigidly either to the strips of wood or to the rods, and are doubled and sewed with very strong thread, so that the said strips of wood and rods may slide freely, as in sheets or coverings, the capability of which is necessary to give elasticity to the whole apparatus, between which they slide.

IMPROVED RECIPROCATING CHURN.

Grovner Goff and Henry Hardick, Stevensville, N. Y.—The object of this invention is to furnish for dairymen an improved churn motion, by which a uniform stroke is imparted to the dasher of the churn with little effort, the length of the stroke being readily adjusted as required. The pitman connection of the crank shaft with the elbow lever changes the rotary motion of the hand crank wheel into the reciprocating motion of the elbow, for working the dasher, the flywheels, and transmitting gearing, facilitating the working of the churn, so that the same may be run with but little effort, producing a uniform and effective stroke of the dasher, and facilitating and accelerating the churning operation. The device is readily applied to the churn, always in order for work, easily adjusted, and effective in operation.

IMPROVED CHURN.

Nelson W. Cone, Delaware, O.—The object of this invention is to provide a churn that will thoroughly and expeditiously cut and agitate the cream, and that is simple and inexpensive in construction. The cream receptacle consists of a rectangular box, having a suitable cover, and having grooves formed at its ends for receiving bars from which fingers or breakers project toward the center of the churn. The shaft is provided with a number of blades or paddles, which project radially from the shaft, and are of such width as to nearly fill the spaces between the breakers. The brackers and blades should be of about the same width, and the number of each should be proportioned to the size of the churn.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED LIFTING JACK.

Joseph S. Kirkwood, McKeesport, Pa., assignor to himself and Henry C. Myers, of same place.—The nature of this invention consists in combining, with a ratchet lifting drum, a lifting rack, which is guided by tapered grooves in two standards, in combination with one or more adjusting screws, which will allow the rack bar to be disengaged from the said ratchet drum whenever desired, and thus quickly raised or lowered by hand. Should the rack bar be raised, and it is desired to lower it quickly, this can be done by turning back the screws and disengaging the bar from its wheel. The ratchet wheel teeth, as well as the teeth on the rack bar, are pitched like saw teeth, so that they are very strong, and will stand considerable strain without fracturing.

IMPROVED MORTISING MACHINE.

William W. Green, Jr., Chicago, Ill., assignor to himself, E. N. Niegelsen, and J. M. Shields, of same place.—This invention has reference to a new construction of mortising machine, and consists of a revolving endless chain saw, formed of pivoted sections or links with cutting teeth, to which the proper tension is imparted by a grooved tension bar, the wood being fed and guided to the mortising saw by a movable treadle-acted table or bench. Any thickness of wood can thus be exposed to the action of the saw, while, by stretching a chain with wider links on the rollers, a mortise of greater width may be cut. By feeding the stuff along the table the mortise is cut by the chain saw. The machine may be employed for mortising, sawing, and recessing lumber, as it is readily controlled by the movable table and worked in rapid and effective manner. To the sides of the tension bar may be attached, by studs or pins, wedge-shaped sections, which impart to the endless cutting chain a certain angle of inclination at both sides, and admit thereby the cutting of wedge-shaped mortises, when such are required.

IMPROVED RAG ENGINE.

Edward D. G. Jones, Pittsfield, Mass.—This invention has relation to engines which are designed for reducing rags to pulp fit for making paper. The nature of this invention consists, first, in novel devices for lifting or adjusting long spindles or cutting cylinders of rag engines, where the bars both arranged outside of the tub or vat, and supported independently thereof, the back bar being so placed, relatively to the tub, that the cutting cylinder can be driven by a belt applied directly to a pulley on the spindle, the two bars being adjustably simultaneously from the front of the tub; second, in a half-box bearing for the rear end of the cylinder spindle, which is supported upon the rear bar, and adjustable at right angles to the longitudinal axes of the spindle; third, in constructing the breast or back fall of the bed in a plane which is tangent to the arc of the concave beneath the cutting cylinder, whereby a free discharge is effected, and the pulp is not thrown back over the cylinder.

IMPROVED FLYING MACHINE.

James J. Pennington, Henryville, Tenn.—This invention relates to machines for navigating the air, and it consists in a fan of peculiar construction, which takes air in from the front of the air ship and forces it out at the rear. The object of this invention is to provide apparatus by which the air may be navigated with facility and safety. The apparatus is suspended by a balloon or upon a rope tramway, and is propelled by drawing the air into the conduits and driving it out of the discharge nozzle. When the apparatus is suspended by a balloon it is raised or lowered by auxiliary fans, and when it is desired to turn the apparatus in a horizontal plane a gate is turned so as to direct the air to one side or the other, as may be required. To steer the air ship vertically and to assist in propulsion a fan is employed having feathering blades, which are turned on their axis, as the fan is rotated, by a central cam. This cam, being movable, permits of reversing the action of the fan.

IMPROVED PUMP.

George W. Robaugh, Ottumwa, Iowa.—The object of this invention is to provide a piston for pumps that may be readily packed without removing it from the pump, also to provide an efficient valve and valve seat. The piston is provided with a flange, against which packing is pressed by the follower. The follower is sectional, being made of two parts. A nut holds these parts in place on the rod and against the packing. When the packing is to be removed the nut is loosened, and one part is removed from the rod by raising it upward and moving it sidewise until it is free from the piston rod. The other part is removed in a similar manner. The valve casing or cage consists of a casting having upon each end a flange for connecting it with the other portion of the pump. This casting is of two diameters, the lower portion being the smaller, and having formed in it the valve seat. In the upper and larger portion there is a rabbet for receiving the grating or cover, which is held in place by the pump barrel. Below the grating there is an annular valve that is fitted to the valve seat, and to a seat formed on its upper surface another valve is fitted. The lift of the annular valve is limited by the grating, and the lift of the other valve is limited by the cage. The lift is thus divided between the two valves, and greater capacity is secured than is possible with a single valve unless the lift is unduly increased.

IMPROVED DEVICE FOR PROPELLING VESSELS.

William F. Morrison, Plattsmouth, Neb.—The object of this invention is to provide an improved device for propelling and steering vessels without agitating the water, the same to be used in canal, river, lake, and ocean navigation. The invention relates particularly to the combination and arrangement of parts for steering a vessel. The desired effect is produced by the expulsion of water from suitably arranged tubes. The water may be discharged through either upper or lower pipe, and the reaction or force against the closed end of the pipe caused by the discharge of the water along through the pipe produced the forward or backward motion of the vessel. The water surrounding the vessel is but little agitated, as the operation of supplying the water to the tank and the discharging of the same for propelling and steering purposes produces only a small effect on the same, the water being discharged at a very slow motion, while the internal reaction at the right angles of various discharge pipes, together with the recoiling force of the confined water on the closed end of the pipes, gives a very effective propelling and steering capacity.

IMPROVED FIRE ESCAPE.

Henry W. Chapman, Blue Rapids, Kan.—The object of this invention is to provide an improved fire escape which may be instantly made ready for use, and by which persons may easily and safely descend from the upper portions of burning buildings. The apparatus when not in use may be folded upon the floor of the room, and may be covered by some article of furniture. When it is required for use a triangular frame is set up in the window, and the person desiring to descend sits upon the seat and lowers himself by the rope or is let down by persons from below. If flame and smoke should issue from the lower portions of the building, the lower end of the rope may be carried away from the building, and the person, in this manner, may be conveyed to a distance from the building.

IMPROVED SEWING MACHINE.

William G. Cummins, Cookeville, Tenn.—This invention relates to improvements in lock-stitch shuttle sewing machines for general family use, which can be stopped or started instantly at the will of the operator without stopping the treadle. The bobbin may also be wound while the needle and feed motion is stopped, and be run by treadle or hand in convenient manner, the object being not only to extend the adaptation, but to simplify the construction, especially of those parts subject to wear and repair, and thus produce a low priced, reliable, and readily repairable sewing machine of wide range. The invention consists essentially of an improved connection of the bobbin winder with the driving shaft and clutch pulley, and by an elbow lever with the presser bar, so as to interrupt the operation of the sewing machine without stopping the treadle. The bobbin winder is retained in raised or lowered position by an elevator and clasp spring, as required.

IMPROVED DITCHING MACHINE.

John H. Rauch, Ida, Mich.—The frame of this improved ditching machine is composed of two parallel lines rigidly secured together at a suitable distance apart by means of bolts and bracing tubes. The frame is mounted on two transporting wheels, one of which is applied on an axle and constructed with a flanged rim, for the purpose of preventing it from slipping on the ground. By means of a draft equalizer the team can walk on the outside of the ditch being dug and draw the machine, and by means of the tongue attachment a team can draw the machine direct. At the front end of the elevator frame is a gage drum, which is provided with sod cutters, and in the rear of this drum, and a little below it, is a shovel plow rigidly fixed to the elevator frame. The earth excavated by this plow is carried up by means of an endless apron attached to a chain and deposited upon another endless apron, which is arranged at right angles to the elevator chain. A drum rolls on the ground in front of the plow and gages the depth the plow should run. The excavated earth is carried up by the elevator apron and deposited upon an apron attached to the chain, which latter will carry the earth off laterally and deposit it in a wagon or upon the ground at a proper distance from the ditch.

IMPROVED CLUTCH FOR STOPPING AND STARTING MACHINERY.

Moses C. Johnson, Hartford, Conn., assignor to Willard Parker, New York city.—Upon a shaft a pulley is placed, the rim of which is bored out to receive a split ring, over which it freely revolves when the ring is unexpanded. A sleeve is placed upon the shaft, and to it a wedge is secured, which consists of a bar of iron or steel that is made flat and tapered at one side and left round upon the other side. When this wedge is forced between the follower and ring, the follower is forced outward, straightening the toggle and throwing the ends of the ring apart, so that the ring fills the rim. It is obvious that when the ring is thus expanded the disk will carry the pulley or the pulley will carry the disk, as may be required.

IMPROVED SHEET METAL ROLLER-SEAMING MACHINE.

Pardon A. Whitney, Southington, Conn.—This invention relates to the construction of the shaft journals and journal boxes. The shafts are of a uniform diameter from the burrs to the gears, so that they may slide through their journal boxes. The lower shaft is journaled in a fixed bearing at the front of the machine, and is turned at the other end, forming shoulders. Upon this portion, and between the shoulders, a cylindrical box is placed, which is split longitudinally and is placed in the frame, where it is clamped by a screw. When the screw is loosened the box, together with the shaft, may be moved longitudinally within certain limits. The front box of the upper shaft is solid, and is fitted to a rectangular opening at the front of the frame. A spiral spring bears this box up, and the screw passes through the cap and bears upon the top of the box. The upper shaft is turned down at its rear end and fitted to a box placed in the back of the frame, and is held in place by a pin that passes through the sides of the frame and forms a pivot, upon which the box swings.

IMPROVED WIRE FENCE TIGHTENER.

Chambers C. La Rue, Blairstown, Iowa.—This invention has relation to devices for tightening wire fences, and the nature of the invention consists in the combination of an angular lever with clamping jaws or pinchers and a connecting rope. The pinchers consist of two levers constructed with gripping jaws, one of which jaws is flanged, so that the other jaw, which is flat, can firmly bite and hold the fence wire. To prevent the wire from being flattened or kinked, the straight jaws of the pinchers are grooved, and in these grooves the wire will lie closely and be gripped by the flanged jaws.

IMPROVED STRIPING MACHINE.

Christopher Van Slyck and Henry S. De Forest, Schenectady, N. Y.—The object of this invention is to furnish an improved machine for forming ring stripes around broom handles, which shall be simple in construction, convenient in use, being easily adjusted to form the wide or the narrow stripes, and reliable in operation, forming the ring stripes with perfect accuracy. The handle to be striped is placed in notches in the sides of the upper ends of arms, the lower ends of which are rigidly attached to the end parts of the shaft, which rocks in bearings in the blocks, and to which is attached an arm which projects downward through a slot in the bed plate. The lower end of the arm is rounded off, and to it is attached a strap, to be connected with a treadle or other device, to enable it to be operated by foot or hand power, to bring the handle in contact with the cylinders by which its point is applied, by the revolution of which the handle is revolved.

IMPROVED LIFE-SAVING APPARATUS.

Walter S. Green, Long Branch, N. J.—This invention relates to apparatus for rescuing persons from wrecks of vessels and other inaccessible places, and it consists of a cart on which are mounted two reels, one for carrying a hawser and the other for carrying a line. The cart is also equipped with a mortar and other appliances. The mortar and balls are used for carrying the smaller line to the vessel. The smaller line is used for hauling the hawser to the vessel, the sand anchors are buried in the sand, and to them the shore end of the hawser is attached. Shear poles are arranged for holding the hawser up out of the water, and the boatswain's chair runs upon the hawser from the vessel to the shore, being hauled by the small line.

IMPROVED FIRE ESCAPE.

Annabella G. Knox, New York city.—This invention relates to an improved fire escape, which may be stored away in compact shape, is instantly ready for use, allows the convenient lowering of children, packages, etc., from upper stories, and forms, finally, a convenient communication with the ground from any height. The invention consists of a rope of suitable strength, having bolstered stops secured at suitable distance to the rope, which is secured to the floor or other support of the upper story, and provided with similarly bolstered loops or handles at the part passing over the window sill. The lower end may be closed to form a loop to be placed around the body of children or around packages and other articles. The fire escape may be stored away in a suitable box in the rooms, halls, or other suitable place, is instantly ready for use, packed into small space, and cheaply manufactured.

IMPROVED FIRE ESCAPE.

George N. Shishmanian, Galveston, Tex.—This invention consists of an air cushion, having a concave upper surface, in the center of which there is an opening of sufficient size to admit a person's body. The cushion is supported above a suitable car by standards that rest upon springs. The object of the invention is to provide apparatus for receiving without injury persons or goods falling from windows of burning buildings. When the apparatus is to be used it is drawn near the building, and beneath the window from which escape is to be made. The person desiring to reach the ground jumps into the concave surface of the air cushion and escapes through the central aperture to the car below. The momentum of the fall is broken by the cushion, and is arrested by the action of the springs. Goods may be thrown upon the cushion without fear of breaking them. The apparatus can be readily moved from place to place, and is more manageable and reliable than ladders.

IMPROVED PACKING FOR COMBINING TUBES OF INJECTORS FOR STEAM BOILERS.

James B. Harkins, Altoona, Pa.—This invention consists of a combining tube for boiler injectors, provided with a rabbet to receive packing rings and a follower, said rabbet being in communication with the passing stream of water through suitable openings extending to the inner surface of the tube, whereby the packing is expanded by the pressure of the water. When the injector is in use the outward pressure of the water and steam exerted in the inner surface of the rings throws them against the barrel of the injector and prevents water and steam from passing between the rings and barrel. The packing thus made and applied requires no adjustment, as it remains tight until it is worn out.

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Notes & Queries

(1) C. P. asks: What can be put on plow mould boards to preserve the polish and keep them from rusting, and will be easily rubbed off? A. Use a mixture of tallow and white lead.

(2) J. M. S. asks: What is wash blue? A. It is commonly a fine grade of Prussian blue mixed with enough oxalic acid or ferrocyanide of potassium to render it soluble in water.

(3) F. H. asks how to make the varnish used for transferring? A. Take mastic in tears, 6½ ozs.; resin, 12½ ozs.; pale Venice turpentine and sandarac, each 25 ozs.; alcohol 5 pints. Dissolve in a clean bottle or can in a warm place, frequently shaking it. When the gum is dissolved, strain it through a lawn sieve and it is fit for use.

How can I make an ink that cannot be erased even with acids? A. To good gall ink add a strong solution of fine soluble Prussian blue in distilled water. This addition makes the ink, which was previously proof against alkalies, equally proof against acids, and forms a writing fluid which cannot be erased without destruction of the paper. The ink writes greenish blue, but afterward turns black.

(4) H. F. asks: 1. Can you tell me how I can check rosin from setting almost immediately when cooling? A. No. 2. Is there a way to odorize the same? A. Use balsam of tolu, sandalwood, olibanum, storax, powdered vanilla, etc. 3. Is the fume arising when melting by heat injurious to health? A. In a concentrated form, yes.

(5) P. B. asks for a process of transferring writing to type metal? A. Sprinkle the ink lines, while moist, with gum arabic in finest powder. When perfectly dry dust off excess, stretch the paper on a smooth level backing, and pour on the fusible metal.

(6) G. S. says: 1. I have a relay wound to 154 ohms resistance. It is wound with 5 ozs. of No. 30 wire. How many feet of wire, same size, shall I add to make it 160 ohms resistance, and if I wish to increase the resistance still more, shall I add wire at the same ratio? A. With a given battery power, the resistance of wires of the same diameter are to each other as their length; thus, a wire twice as long as another has twice the resistance. We believe you have rated the resistance higher than it should be in the case you mention; the proper way is, as you are winding your coil, to compare its resistance from time to time with a standard, as we will explain in a future issue. 2. Is not common sheet zinc melted and cast into the desired shape just as good as the zincs made on purpose for battery use? A. No. It often contains lead. 3. I wish to galvanize a mile or two of wire; can I do it by drawing the wire through a tank of sulphuric acid into a tank of muriate of zinc, then through the melted zinc? A. Yes. Use sulphuric acid, with twenty or thirty times its weight of water. Let the wire remain in the acid water until the scale, if there be any on it, be entirely removed.

(7) A. K. says: I propose to make an induction coil on the following plan: Using No. 28 wire for the secondary coil, I intend to wind cotton yarn between the convolutions of wire, so that they cannot touch, winding it of course simultaneously and on varnished paper. Having completed one layer, I give it a coat or two of quickly drying copal varnish, and cover the whole layer with strong, varnished paper, varnished on both sides; when the paper is dry, I wind the next layer in the same manner, and treat it the same as the first, and so each proceeding layer till the section is finished. To avoid having layers of great and different tension of electricity too near together, I intend to compose the coil of three sections, each one completely finished, in the above described manner, by itself, and connected by a binding screw. Do you think the insulation will be sufficient? A. Your wire should be finer, say No. 32 instead of 28. The insulation you mention will not give a good result, because it takes too much room. Silk or cotton is the best, although, if you are careful, you can accomplish the result by passing your wire through any quick drying varnish or paint; then over a hot stove, and through cold air to the coil, laying a strip of thin paraffined paper between each layer.

(8) H. H. C. says: Would it be better to have the schoolroom of a second story on the north end and playroom on south, or *vice versa?* How can we deaden the sound on the floor, so as not to have one school disturb the other? A. The schoolroom should be placed at the north end of the building. To deafen the floors at little expense, lay two thicknesses of building paper upon the floor joists under the planking.

(9) C. A. W. B. asks for a cheap filter to cleanse water from a roof before it enters a cistern? A. Let the water run through a cask or keg of charcoal.

(10) C. A. M. asks: 1. What is the best method of preparing an object of wax or other non-conductable substance for electro-deposit, so as not to fill up deep cut fine lines? A. Covering with plumbago or black lead. The ordinary article sold for household use is not good; purchase from some dealer in scientific apparatus. 2. When graphite is used, how is it made fine enough, and how is it applied, so as to adhere to the object? A. It is carefully ground in water, apply with a camel's hair brush, work in lightly and occasionally breathe on the surface if the powder does not adhere readily, and when this will not suffice, hold the spot for an instant over the mouth of a bottle containing spirits of wine.

(11) W. J. C. asks how to make a telephone? A. The cut we give on first page, No. 14, present volume, is to scale, and once, twice, or three times the size will work well. The spools are of copper wire No. 40. Silk insulation, and the armature is a circular disk of thin ferrotype plate, such as is used by photographers.

(12) T. N. says: 1. I have an induction coil containing 600 feet of secondary, which gives as much as a man thoroughly "pickled" in electricity can bear, with only half a square inch of zinc surface (bichromate battery). Is not this a very good result? A. Very good, if the man has not become sensitive by being "pickled." 2. Can a method of winding naked wire on helices be patented? A. Yes, though the principle cannot be. 3. Can a combination of leading and secondary wires be patented? A. Yes. 4. Can tin be copper plated without using an alkaline solution of copper? A. Yes, but it is troublesome and expensive. 5. What is the easiest way of removing the tin? A. By dipping it into strong sulphuric acid, and when the tin is removed washing with clean water. 6. Will you give me a formula for finding the resistance of primary coils? A. The proper way is to compare the resistance by means of a galvanometer and battery, with a standard of resistance, which may be purchased from the electrical instrument makers.

(13) J. P. asks for a method of making the purple precipitate of Cassius from pure gold of 24 karats, the same as is used for staining glass, etc.? A. Dissolve the gold in a warmed mixture of 3 parts hydrochloric acid and 1 of nitric acid, and evaporate the solution nearly to dryness. Dissolve 1 part of this in about 10 parts of water, and add to it protochloride of tin (stannous chloride) 1 part, dissolved in a small quantity of diluted hydrochloric acid, and 12 parts perchloride of tin (stannic chloride). Wash and dry the precipitate. Before adding the tin salts, the solution of gold should be filtered through a cornet of fine white filtering paper in order to remove what chloride of silver remains mixed with it.

(14) Z. I. asks for a material for closing the pores of a large stoneware box to render it impervious to acids? A. What acids and of what concentration?

Please give me a cement to resist boiling water, suitable for mending the delicate handle of a china cup? A. Soak isinglass in cold water until it is soft, and then dissolve it in the smallest possible quantity of hot proof spirit. In 2 ozs. of this mixture dissolve 10 grains of ammoniacum, and while still liquid, half a drachm of mastic dissolved in three drachms of rectified spirit. Mix well together and bottle for use. This is the "diamond cement." To use it, stand the bottle for a moment in warm water to render the cement fluid, and apply to the fracture immediately. It resists water and moisture perfectly.

(15) ——, from Jersey City, asks: Will it make any difference whether the electro-voltaic chain belt is plated aluminum, silver or nickel? Will not the silver be just as good? A. The only advantage of the aluminum is that it does not readily tarnish; but silver is a better conductor, and will answer as well.

(16) J. E. A. wishes to know: 1. Which will make the strongest electro-magnet, to coil the insulated wire around the core similar to thread on a spool, or to coil the wire from one end of core to the other, then carry straight back parallel with core to place of beginning, and coil as before? A. Same as the thread is on a spool. 2. Is it an intense or a quantitative current that will make the most powerful electro-magnet? A. An intense current will produce the best magnetic effect by means of a magnet wound with fine wire, having resistance; a quantitative current, by a magnet with coarse wire, having less resistance. 3. If a current of electricity is passed around a number of similar electro-magnets, would all of the magnets be of equal power? A. Yes. 4. If opposite poles of electro-magnets are brought together, will the attraction be greater than when an armature of soft iron is used in place of one of the electro-magnets? A. Yes. 5. If similar poles are brought together, will the repelling power be as great as the attracting power is when opposite poles are used? A. No.

(17) W. E. D. says: In making rubber stamps by Park's method, shall I immerse the whole form in bisulphide of carbon and chloride of sulphur, or remove the mould and rubber from the press and immerse it in the solution? How long a time shall I keep it in the solution? In vulcanizing by the dry process, how can I remedy the sticking in the mould? A. Remove the mould from the form. A few minutes' immersion, depending upon the bulk of the form, will usually suffice. Use powdered magnesia on the mould to prevent sticking.

(18) A. S. asks: By exhausting the air from a flask of water with an air pump, would it produce any considerable degree of coldness in the water without the use of sulphuric acid, as it is used in Carré's ice machine? A. Yes, if properly arranged, and the flask is covered with some non-conductor of heat. A large pump will be requisite.

(19) F. H. T. asks if alcohol is injurious to leather? A. It is not injurious unless applied in excessive quantities, in which case it may detract from the suppleness and durability of the leather by its solvent action on the natural oils and stuffing. In ordinary liquid shoe dressing strong borax water constitutes the solvent for the shellac instead of alcohol, as in the German preparation.

(20) W. H. asks if a shaft 4¼ inches in diameter, supporting a weight varying from 1½ to 2½ tons and running at a speed varying from 500 to 700 per minute, can be run on two friction wheels so placed together as to form a bearing instead of the ordinary box bearing? A. The arrangement is perfectly feasible. Make the friction wheels with diameter four or five times that of the shaft.

(21) R. P. S. says: A friend has a country residence on a beach; the lawn is even with the top of the wall against which the water rises. Every spring the wall is washed out. Now if the wall was laid in Portland cement, would it be a sure protection? A. If, in rebuilding the wall, time is afforded for the Portland cement to set before being submerged or washed by the water, it will then remain permanently. It is important, also, that the wall should have a deep foundation. If the wall is wet at all seasons at every rise of the tide, it would then be well to construct large blocks of it on the bank, where it would have an opportunity to become hard and cohere, and then at low tide lower these blocks into their places in the wall. Such a wall would not wash out.

(22) E. P. F. asks what sizing sign painters use for smalting purposes? A. Mix a stiff oil color as near the color of the smalts to be used as possible. Sift these on to the fresh paint with a fine sieve, allowing the work to lie in a horizontal position until sufficiently dry to retain them.

(23) A. I. W. asks how to restore to its former elasticity a quantity of rubber sponge, which, having lain unused for several years, has become quite hard? A. The rubber has probably suffered partial oxidation and cannot be restored to its former softness.

(24) W. W. says: I have built an icehouse above the ground, with hollow walls 11 inches thick filled with sawdust. I am now building one with hollow walls filled with slacked oyster shell lime. Is this any better than the sawdust? How would I ventilate it so I can keep ice during the summer months? A. Ice keeps well in houses built of wood above ground where the hollow space is 10 inches wide and is filled in with sawdust; a level ceiling over the ice 10 inches thick being also so filled in. The floor should be paved with concrete inclining to the center, where a trapped opening should receive the water and discharge it into a drain beneath. Ventilation should be afforded by a tube or shaft about 6 inches square, extending from the center of the ceiling to a short distance above the ridge of the roof. The ice should be supported upon a tier of beams laid above the concrete bottom. The larger the quantity the better it keeps—a cube of 12 feet will keep well.

(25) C. E. A. says: If a building be sufficiently protected by lightning rods, will the fluid ever strike them with sufficient intensity to be heard, or will they be constantly drawing off so much of the fluid that enough cannot be collected in the vicinity to produce a report? A. They will draw off the electricity silently and harmlessly, if they are thick enough and well connected with the earth; if these requirements are not fulfilled, the house would be safer without them, as the electricity will choose other courses as well, according to the degree of their conductivity to the earth as compared with that of the lightning rods.

(26) F. A. P. & Bro. ask how to grind hard chilled metal castings? A. Use artificial emery wheels. State the kind of metal to manufacturers of such wheels; they will provide one suitable for the work.

(27) W. R. T. asks if it would have been practical to have driven the English channel twin steamer Castalia with one wheel, driven with the engine placed in one hull, or with one wheel driven with two engines, one engine in each hull, the engines attached to the same shaft? A. Yes.

(28) C. W. asks if the annealing process has a tendency to weaken metals. Is the cohesive or tensile strain less in soft than in hard metals? A. No.

(29) F. A. B. asks what kind of rubber to use in making rubber stamps? A. Use common gum rubber, obtainable at any of the larger rubber dealers. The gum rubber sold by druggists is often worthless, owing to long exposure to light and air.

(30) W. J. McG. asks: 1. What are the melting points of iron, lead, copper, tin, silver, and gold? A. Iron melts at 2786° Fah., lead at 612°, copper at 1996°, tin at 442°, silver at 1873° and gold at 2016°. 2. What degree of heat is required to convert these metals into gases? A. It has not been determined accurately—from 2,000 to 10,000°. 3. One pound falling through a distance of 10 feet exerts a force of 10 foot lbs. on the substance on which it falls. What would be the weight of a mass of material which would exert the same force, by pressure, when resting quietly on the substance? A. The weight would strike the surface with a force equal to $\sqrt{643\frac{1}{2}}$ lbs. pressure at the moment of contact. The mass must therefore weigh $\sqrt{643\frac{1}{2}}$ (=about 23·35 lbs.), since it must exert the same pressure.

(31) J. D. asks: How is phosphor-bronze manufactured? A. True phosphor-bronze is a combination, without intermediates, of copper with phosphorus. It is simply a phosphide of copper in definite proportions. The copper must be commercially pure, being exempt from arsenic, antimony, iron or zinc. The maximum and minimum percentages of phosphorus in the bronze are 2 and 4.

(32) A. M. C. says: I have a pump that has a tight foot valve and the water is always up to the barrel of the pump, but it will not start, after resting a while, without filling the air chamber and letting it remain for 3 or 4 minutes. A. It is quite probable that the piston leaks.

(33) C. J. & Co. ask: 1. What reduction in the grate bars is necessary when "slack" is to be burnt? A. They should be sufficiently close together to prevent material loss from unburnt fuel falling through. 2. Is there any existing patent in the use of a blower to burning of coal screenings or slack? A. No. 3. Would there be any utility in placing air jets back of the bridge wall to burn the smoke? A. No.

(34) B. F. B. asks for a remedy for a deposit that collects on the bottom of steam boilers. A. Use a feed water heater with sediment collector.

(35) W. H. S. says: We finish silk goods on a cylinder heated with red hot irons. Will it have any effect on the goods if the cylinder be heated with steam, so long as we get the same temperature? A. Probably not.

(36) G. B. D. asks: 1. What are the advantages of the oscillating steam engine? A. Fewer working parts. 2. What are the mechanical difficulties that hinder its coming into use? A. Unequal wear of the trunnions and packing of the same. 3. If these difficulties could be surmounted, would not this style of engine be preferable to the reciprocating? A. Probably, by many engineers.

(37) F. R. M. asks: How many square feet are there in the surface of the earth? A. We do not know that this calculation has ever been attempted. Brande gives the surface, on the assumption that the earth is a sphere, as 196,625,000 square miles.

(38) H. McK. asks: 1. What sized circular saw can I run with a steam engine 2 inches bore and 4 inches stroke, running 300 revolutions per minute, with boiler carrying 50 lbs. steam per square inch? A. Diameter 8 to 10 inches. 2. What will be proper speed for the saw? A. 3,500 revolutions per minute.

(39) J. T. asks: How many lbs. will 4 wrought iron round rods sustain, rods 15 feet long and 3¼ inches diameter? Will square rods sustain more pressure than round rods, length and diameter same? A. If you refer to tensile strength, it is from 40,000 to 60,000 lbs. per square inch. In the case of square bars, as their sectional area is greater, they are stronger.

(40) W. C. B. asks: Would it be practical to drive a grist mill with one or two horses, in this way: Build a large wheel 36 feet diameter, place the horses on the periphery, then gear for speed, as is usual in breast or overshot water wheels. Would I gain anything over the common horse powers in use? A. No.

(41) F. B. M. asks how to drill a hole through a watch crystal and not break it? A. Drilling from both sides with a common drill is a very good preventative of breaking. Work lightly and use turpen-

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tine as a lubricant. Or use a flat-ended copper drill supplied with coarse emery and water.

(42) E. A. D. P. says: I have heard it asserted that south of the equator the magnetic needle points to the south instead of the north. Is it true, and if so what is the cause? A. The statement is not correct. Local causes sometimes affect the needle so as to invert its polarity.

(43) R. G. B. asks how to clean a brass chandelier that is badly fly specked, so as to restore it to its former color? A. The treatment must depend somewhat upon the nature of the lacquer. Try a little fine rottenstone, slightly moistened and applied gently on a piece of chamois skin: or, if the lacquer will bear it, use warm water and the yolk of an egg.

(44) J. M. B. asks: What is the process of making dies in steel by sinking metal, softer than the steel hub, into the die? Is the process patented? A. No. See "How Greenbacks are Made," in Nos. 14 and 15 SCIENTIFIC AMERICAN, vol. 27, 1872.

(45) G. E. S. writes: 1. I wish to lift a weight of 2 ozs. 1 inch high, once in every second; what size electro-magnet, and what size and length of wire do I require? A. Use a piece of soft half inch round iron, nine inches long, bent in the U form for the core, and 600 feet of No. 30 copper wire, cotton covered, for the spools: arrange your armature on a lever, with the 2 oz. weight at one end, so that the armature need only move a short distance to do the work. 2. What kind of battery would you recommend for working this for several months without attention? A. Use ten cups of gravity battery, which may consist of a disk of zinc and one of copper placed over, and parallel with each other, in a glass jar; the copper being imbedded in about 1 lb. of sulphate of copper in crystals placed at the bottom of the jar; the zinc is suspended about 4 inches above. The battery is set in action by pouring in a solution of sulphate of zinc, until the zinc is covered: the copper of one cup is connected with the zinc of the next, by means of a "kerite" or gutta percha insulated wire running through the solution and riveted to the copper disk.

(46) W. D. B. asks: Which is the heavier, 1 cubic yard of the air that we breathe on a damp and cloudy day, or the same quantity of the same air on a dry hot day? A. Air saturated with moisture is specifically heavier than dry air at a like temperature; but the total atmospheric or barometric pressure in a given locality is usually less in wet than in dry weather, the temperature being the same.

(47) D. K. says: I require for the benefit of my work a temperature of 75°, average temperature for the three winter months. I have to make 30° artificial heat, and it costs $100. Suppose I am in a locality where the average temperature for those three months is 30° and have to make 45° artificial heat, how much more will it cost, other things being equal? A. This would depend much upon the arrangement and perfection of the heat radiators, and the character and tightness of the walls, etc. Probably a third more fuel would suffice.

(48) F. D. G. asks for a filling for a rice hulling stone that has been broken? A. Use pulverized stone and a strong solution of alum in water.

(49) J. A. J. desires to know what causes it to rain immediately after every large battle? A. The concussions of the explosions are supposed to cause the clouds to gather. The theory is very vague.

(50) C. C. asks: What is the fastest rate of speed attained by fast trains on American and English railroads? A. About 60 miles an hour.

How can I expand or diminish the size diametrically of a small brass tubing? A. By drawing.

(51) J. H. B. asks: What will prevent iron hoops on barrels from rusting? The barrels are stored in a very damp cellar. A. Cover the hoops with a thick coat of good paint or asphaltum varnish.

(52) J. S. F. asks: Can anthracite coal dust be used as fuel under a bituminous coal burning boiler by introducing a series of steam jets under the furnace bars? A. Yes, but it may be necessary to change the grate bars.

(53) H. A. L. asks: 1. Can water be compressed? A. The compressibility of water is found to be $\frac{1}{47}$millionth of its bulk for each atmosphere (=about 15 lbs. per square inch) of pressure. 2. How or in what way? A. Usually in strong vessels of glass by powerful screw pressure exerted on a piston of soft metal. A suitable glass flask with the neck drawn out into a fine tube is completely filled with hot water (pure distilled) and a little globule of mercury worked into the tube to indicate by its movements the change of volume of the water within. The flask is placed in the strong vessel referred to, surrounded by water, to prevent change in volume of the flask, and the pressure applied. The fall of the mercury globule indicates the compression of the water.

(54) I. B. K. asks if a flywheel resting in two balances and revolving, would the balances show any increase of weight? A. No.

(55) E. D. asks how to make an ink for postal cards, which will be colorless until heated? A. Sulphate of copper and sal ammoniac, mixed in equal parts, will become yellow if exposed to the fire. A weak solution of chloride of cobalt and chloride of nickel is turned to a green by heat. A solution of acetate of cobalt, with a little nitrate added to it, turns to a rose color by heat, and disappears when cold. The others are more or less indelible when once developed.

(56) D. A. asks how to enlarge or reduce a drawing from a square to a parallelogram of any given proportions? A. You can change the relative proportions by dividing the original design into small squares and transferring the parts contained in these squares to those of the desired forms, and *vice versa*.

(57) W. S. W. says: We have two boilers connected at bottom by a mud drum with six inch openings. At the top by a steam drum with openings the same. We want to work them with separate fires, where at times steam will be made faster in one than in the other. Will there be any difficulty in keeping the supply of water equal? A. Probably not.

(58) J. E. L. asks: Will I be obliged to take a license out to fire a boiler in New York city that does no work but furnish steam to pump water to the top of a hotel? A. Yes.

(59) J. W. H. asks where to cramp an exhaust on a high pressure engine to make it sound loud? A. At the end of the exhaust pipe.

(60) F. D. W. asks: What are the so-called seven wonders of the world? A. 1. The Pyramids of Egypt. 2. The Mausoleum, built by Artemisia, wife of Mausolus, king of Caria. 3. The Temple of Diana at Ephesus. 4. The Walls and Hanging Gardens of Babylon. 5. The Colossus of Rhodes. 6. The Statue of Jupiter Olympus. 7. The Pharos or Watch Tower built by Ptolemy.

(61) B. D. W. asks for the rule for increasing or diminishing the speed of machinery by shafting and pulley? A. See No. 12, p. 181, current volume.

Is corn meal kiln-dried before or after it is ground? A. After.

(62) D. F. H. asks: In a steam boiler, where is the steam made? A. It is made at the heating surface.

(63) G. W. asks: 1. What kind of oil is used for tempering steel? A. Lard oil. 2. Can a circular saw be tempered without springing it? A. No. After being tempered, saws are put in proper shape by hammering.

(64) H. & C. ask how to prevent scale in steam boilers? A. Preventives depend upon the quality of the feed water. The use of heaters to precipitate solid impurities is recommended.

(65) W. McC. asks how to fix the warp in a hand loom for weaving? A. You will find information in Gilroy's "Art of Weaving."

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. P. S.—The powder contains silicate of alumina, lime, and magnesia carbonates, sesquioxide of iron, sand, traces of alkalies, and films of mica. It is probably the washings of felspathic and limestone rocks. It is not valuable.—L. T. S.—They are, for the most part, impure clays. Nos. 1 and 4 might be used for brick-making. They contain considerable quantities of sesquioxide of iron, lime, and silica (impurities). No. 2 is aluminite—a hydrous sulphate of alumina—mixed with a little clay, sand, and gypsum. It might possibly be used in alum making. No. 3, after washing, will answer for white table ware and pottery in general.—H. S. S. C.—The bright particles and the rock are mostly of iron sulphide—marcasite. It contains a trace of silver and probably a little gold.—Mineral from ——, Derry, N. H. It is a variety of fluorspar—fluoride of calcium.—G. G. —No. 1 contains chalcopyrite—sulphide of copper—altered marcasite, and a trace of nickel. It probably contains enough copper to be of value as an ore of that metal. No. 3, quartzose with pyrites. No. 5, quartz containing hornblende, mica, and limonite. No. 6 is mica schist with limonite. No. 7 is talco-schist. No. 8 is specular iron ore. Nos. 2 and 4 are missing.—R. A. W.—They are crystals of tourmaline imbedded in quartz rock.—E. N. C.—It is a variety of pipe clay richly colored by sesquioxide of iron. It may be used for pipes, tiles, common pottery, bricks, etc.—I. M. P.—It is marcasite—composed of sulphur and iron.—J. W. F.—The packages should have been labeled; we cannot identify them.—J. F. S.—It is a limestone containing a large percentage of silica; the bright metallic particles consist of iron pyrites—see p. 7, vol. 36, of the SCIENTIFIC AMERICAN. The percentage of alumina is somewhat large. —N. L. L.—It is a clayey deposit showing considerable potash. An opinion of the value of a soil is dependent upon the results of a chemical analysis.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Sea in Sahara. By M. M.

On Locomotive Wheel Sliding. By J. F. A.

On Domestic Water Supply in the Country. By P. A. S.

On the Tides. By W. H.

On How to File the Scientific. By G. H. B.

On Patent Medicines and Secret Remedies. By V. N.

On the Congo River. By W. M. R.

On Anthrax-Epizooty. By J. S.

On the Red and the Two-lined Salamander. By C. F. S.

Also inquiries and answers from the following:

S. C.—J. D. P.—F. C. S.—I. S.—A. G. S.—A. S. P.—H. M.—G. W. G.—L. H. M.—J. G. J.—S. O. & Bro.—R. M., Jr.—A. M.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes steam pumps to be applied to sailing vessels? Who makes and sells dynamite powder?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

September 18, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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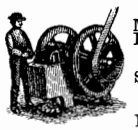
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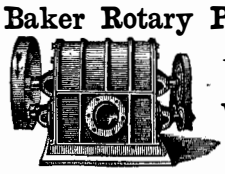
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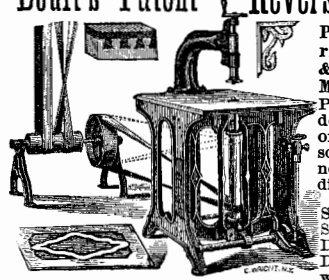
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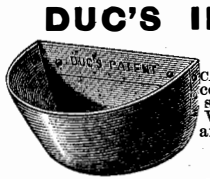

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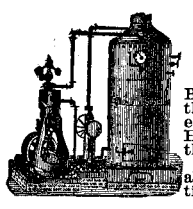

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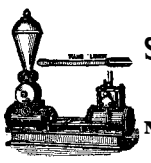

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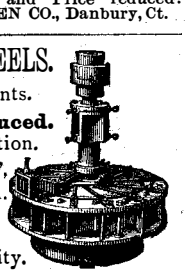

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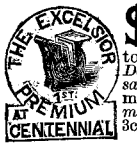

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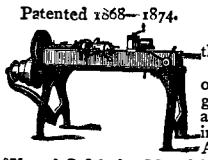

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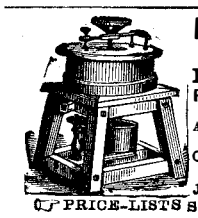

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